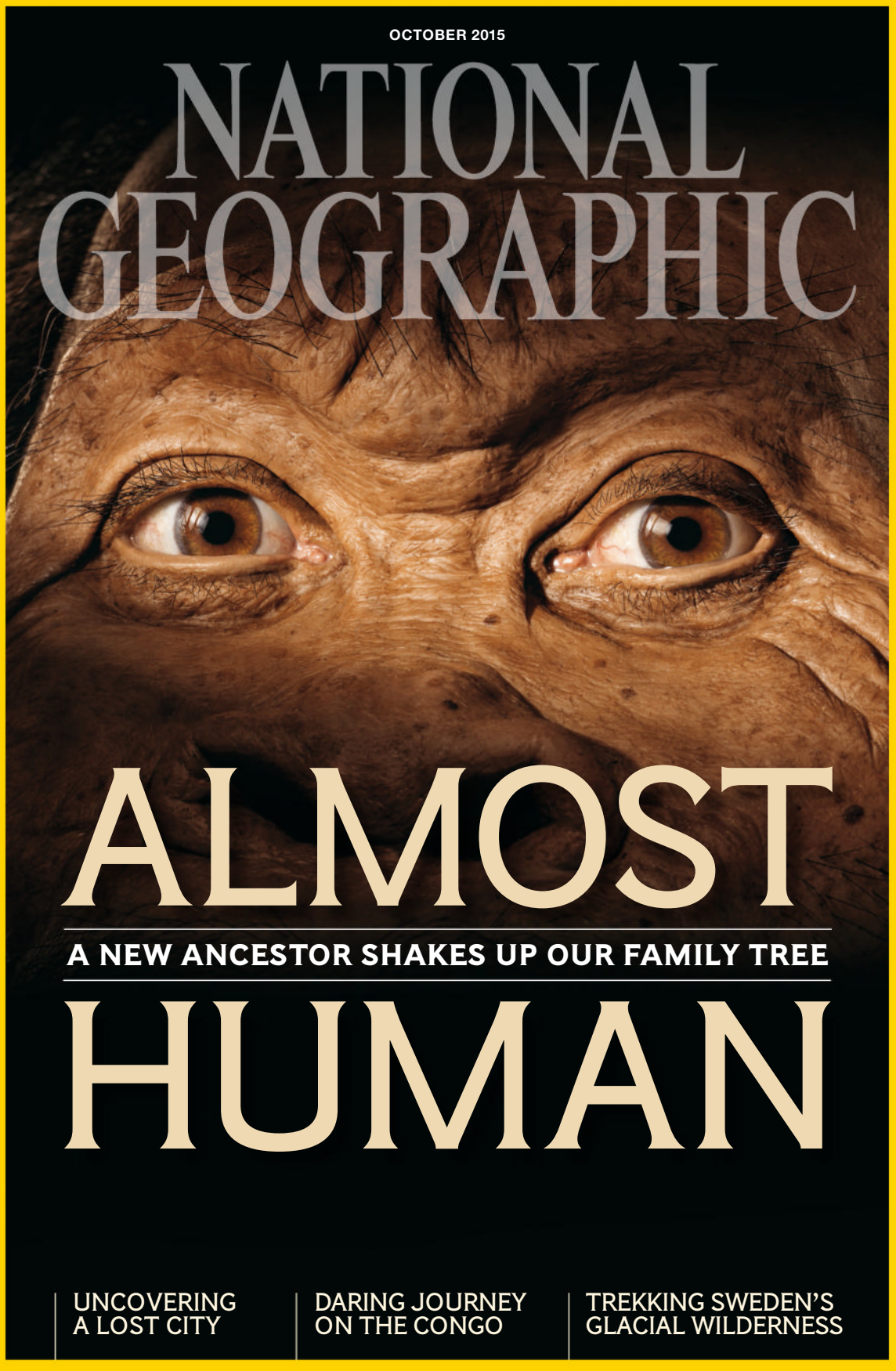
OCTOBER 2015

NATIONAL GEOGRAPHIC



ALMOST HUMAN

A NEW ANCESTOR SHAKES UP OUR FAMILY TREE

UNCOVERING A LOST CITY

DARING JOURNEY ON THE CONGO

TREKKING SWEDEN'S GLACIAL WILDERNESS



Indochinese Tiger *(Panthera tigris corbetti)*
Size: Head to tip of tail, 2.4 – 3.1 m (7.8 – 10.2 ft); shoulder height, approx. 90 cm (3 ft) **Weight:** 100 – 195 kg (220 – 430 lb) **Habitat:** Moist semi-deciduous forests and montane areas with mixed coniferous forests **Surviving number:** Estimated at 350 - 500

Photographed by Steve Winter

WILDLIFE AS CANON SEES IT

Meet the original. A remarkable embodiment of power and grace, the Indochinese tiger is thought to be the ancestor to all other tiger subspecies, which radiated out of Indochinese regions 70,000 to 100,000 years ago. Remaining in the forests where it has roamed for ages, this tiger uses scent markings to communicate and to define its territories. But populations have been hit hard by habitat destruction and fragmentation, overhunting of prey sources and commercial poaching. The tiger that began it all may now be facing the end.

As Canon sees it, images have the power to raise awareness of the threats facing endangered species and the natural environment, helping us make the world a better place.



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NATIONAL GEOGRAPHIC
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Archaeologist Chris Fisher leads a team searching for ruins of an ancient city hidden in the jungle in La Mosquitia, Honduras.

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Laser-mapping technology uncovers extensive ruins in a Honduran jungle rumored to contain a mythic White City. *By Douglas Preston* *Photographs by Dave Yoder*

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Fossils found deep in a South African cave raise new questions about what it means to be human.
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Story and Photo Illustrations by Michael D. Kern

On the Cover Paleoartist John Gurche used fossils from a South African cave to reconstruct the face of *Homo naledi*, the newest addition to the genus *Homo*. *Photo by Mark Thiessen, NGM Staff*

Corrections and Clarifications Go to *ngm.com/more*.

The Risks of Storytelling

"We believe in the power of science, exploration, and storytelling to change the world." That's National Geographic's mission statement, and living it is not without risks. Charging hippos, aggressive sharks, stampeding elephants, even abduction by rebels: Our contributors and explorers have been through it all. Sometimes, though, the biggest problems are caused by the smallest things—which brings us to the plight of some colleagues in this month's issue.



This sand fly—adults are about 3 mm, or 1/8 inch, long—spreads the leishmaniasis that our team members got.

"We didn't know about the sand flies," says Doug Preston, who wrote our article on the discovery of a pre-Columbian city in a remote rain forest in eastern Honduras. What Preston, photographer Dave Yoder, and National Geographic grantee Chris Fisher did know, early on, was that the assignment would be challenging. "From the air, it looked like a tropical paradise," Preston says. On the ground, "it rained incessantly. The mud was thigh-deep. There were venomous snakes and lots of insects."

And sand flies—"clouds of sand flies," Preston says—which can transmit a parasitic, flesh-rotting, potentially fatal disease he had barely heard of: leishmaniasis. It's found in parts of 90 countries in the tropics, subtropics, and southern Europe. Yoder, Fisher, and at least six other team members contracted leishmaniasis, and it's serious enough that several are being treated at the National Institutes of Health in Bethesda, Maryland.

The intravenous infusions they must undergo, all agree, are worse than the open sores and other immediate complications of the illness. Fisher, an archaeologist at Colorado State University, suffered intense pain during the infusions, and on the plane home broke out in a measles-like rash. "I felt like I had the world's worst hangover," he says. If left untreated, the disease can recur years, even decades, later, attacking tissues of the nose and lips and resulting in disfigurement.

You might assume, given these sobering details, that the team would never want to set foot in that jungle again. Quite the contrary. As I write this, Yoder and Fisher are making plans to return and continue the excavation and documentation of the lost city. "I would certainly do this again," says Preston, who has covered archaeology for more than 30 years. "Nothing really good happens without some risk."



Susan Goldberg, *Editor in Chief*

PHOTO: RAY WILSON



BRIGHT IDEAS CAN CHANGE THE WORLD

***CARBON ROOTS INTERNATIONAL* FIGHTS DEFORESTATION AND REVITALIZES FARMLANDS.**

With the majority of Haitians using charcoal and wood for energy, extreme deforestation has driven the cost of cooking fuel exorbitantly high. A social enterprise venture, *Carbon Roots International,* trains farmers and small entrepreneurs on how to produce affordable green charcoal created from the carbon-rich char dust of agricultural waste. The char is also used by farmers to increase soil fertility.

Carbon Roots International represents one of the 29 real-world projects focused on innovative energy solutions that have received grants from The Great Energy Challenge, a National Geographic initiative in partnership with Shell. When we push the way we think about energy, we help ensure a sustainable energy future.

Check out **greatenergychallenge.com** to learn more and discover new ways to change the way you think about energy in your life.

The Great Energy Challenge

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My Work Since the White House and My Legacy

Jimmy Carter, 90, was president of the United States from 1977 to 1981. In 1982 he and his wife, Rosalynn, founded the Carter Center to work on peace, justice, and health issues; in 2002 he was awarded the Nobel Peace Prize. This interview took place before Carter's August 12 announcement that he'd been diagnosed with cancer and would seek treatment.

Why did you found the Carter Center?
When I left the White House, I wanted to capitalize on my having been president of a great country, and I thought about filling vacuums and things I knew governments didn't do. The first concept we had was to negotiate peace agreements between people who wouldn't be accepted by normal governments; that's something we've continued through the years with the Maoists in Nepal, Kim Il Sung in North Korea, and Hamas and Fatah in the Palestinian community. Later we filled other vacuums, including monitoring elections and dealing with neglected tropical diseases.

Which center efforts make you proudest?
One, we have the only international task force on disease eradication. We settled on guinea worm and found it in 23,700 villages. Since then we've reduced the number of cases from 3.6 million to 126. Second, we promote human rights in the form of democracy and freedom. By the end of this year the Carter Center will probably have monitored more than a hundred elections to validate they're conducted honestly and safely.

What will be the center's next big challenge?
The horrible abuse of women and girls around the world. Many are strangled at birth by their parents or aborted when a fetus is determined to be female. Some 70 percent of the people sold across international borders now are females, to be sold into sexual slavery. One out of five college freshman girls can expect to be sexually assaulted before they graduate. This crime is seldom investigated in our country, and it also exists in our military. These are things on which the Carter Center will focus a lot of our attention in future years.

PHOTO: MARTIN SCHOELLER, AUGUST



PETS CHANGE LIVES

A Pet Food Bank Keeps Families Together

Sometimes, people in need are willing to make incredible sacrifices for the pets they love. "I've known of many people who have gone without food themselves in order to feed their pets—or are contemplating surrendering them to the shelter," said Jennifer Rowell, Shelter Director at the Michigan Humane Society (MHS). But thanks to an innovative Pet Food Bank launched nearly 20 years ago, there's another option for members of the Detroit community who are struggling financially.



"It's part of MHS's Keeping Families Together initiative," said Michael Robbins, VP and CMO. "Offering pet owners food provides a bridge that helps them stay connected" to their beloved companions. Like most shelters, MHS measures success partially by the number of animals adopted into good homes. Last year, that figure was 8,202, a remarkable achievement. But ensuring that pets stay in good homes is another critical goal.

The shelter works toward that goal by distributing free pet food to families in need. That food comes from lots of sources, including community members and larger organizations who share MHS's goals. Because MHS gets all the food it needs to feed the cats and dogs at the shelter from Purina ONE, all the other donations of food are available for the Pet Food Bank program. "We've been able to amplify the program through our partnership with Purina ONE, which provides food for all of our shelter dogs and cats as well as those going into new homes," said Mike. "Knowing they're being fed nutritious food that they like to eat frees us up to give all the pet food donated by the community to families in need. Purina ONE is truly invested in sustainable relationships between pets and humans."

All that's required to receive a week's supply of food is a driver's license or state I.D. card and proof of financial assistance. "We don't want to make the process daunting," said Mike. "We want to make it easy for them to access the program for short or long term." Obviously, he added, the need fluctuates. "During the recession in 2008, few states were hit harder than Michigan. Fortunately, I would put the generosity of the Detroit community up there with any in the country."

The Keeping Families Together initiative also supplies low-cost vaccination, micro-chipping, spay/neuter programs, and a free behavior help line, but the Pet Food Bank is its primary focus. **In 2014, MHS donated 11,046 parcels of pet food to around 3,000 families.** Jennifer, a 16-year veteran at the shelter, has witnessed the program's impact. "One wheelchair-bound gentleman stretches his budget to provide care for his dog of eight years. When he comes here, we know it's his last option," she said. "For some of our clients, including senior citizens, these animals are their family, the one constant source of love in their lives that helps them get up in the morning and keep going." MHS is proud to be a part of helping keep those families together.

Created with Purina ONE by
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Purina ONE supports a network of shelter partners by providing complete, balanced nutrition to help promote shelter pets' whole body health for today and tomorrow—as well as helping to spread the word. To learn more, visit purinaone.com.

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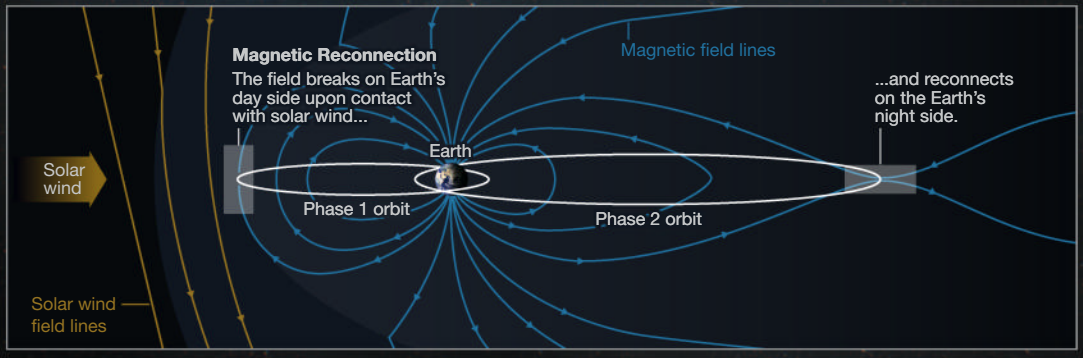
Space weather could be the next frontier in forecasting. Scientists want to understand how forces in space cause events like geomagnetic storms that can disrupt power grids and GPS systems on Earth.

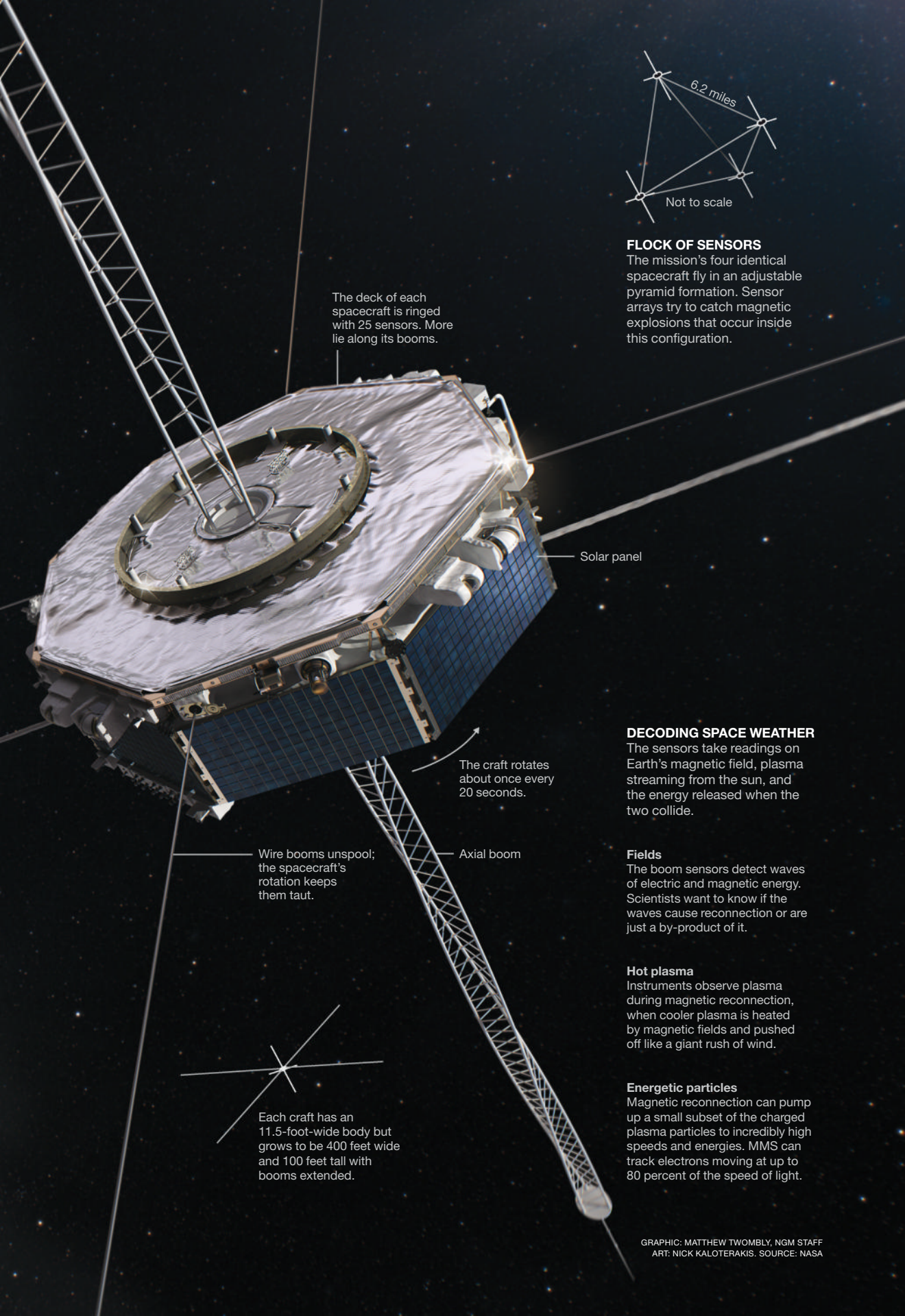
NASA launched its two-year Magnetospheric Multiscale Mission (MMS) last March to study magnetic reconnection, a key driver of what scientists call space weather, which "starts with a wind, made up of particles streaming from the sun," says MMS Program Scientist Bill Paterson. Four identical spacecraft are now orbiting Earth, measuring traces of this physical process.

Instead of rain and tornadoes, think jets of plasma energized by this magnetic reconnection. Space weather phenomena are generated as magnetic fields connect and disconnect, explosively releasing energy.

This kind of disruption can scramble spacecraft computers and make the aurora borealis brighter. But "it's hard to predict," says Paterson. "Magnetic reconnection is a piece of the puzzle." —*Eve Conant*

MAKING A CONNECTION
MMS's two-stage orbit will take it through areas in Earth's magnetosphere, where the magnetic field releases energy as it breaks and reconnects.





GRAPHIC: MATTHEW TWOMBLY, NGM STAFF
ART: NICK KALOTERAKIS. SOURCE: NASA

If you have type 2 diabetes



Jerry G.

PHOTOGRAPHER WITH TYPE 2 DIABETES

ACTOR PORTRAYAL

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Tell your healthcare provider if you get a lump or swelling in your neck, have hoarseness, trouble swallowing, or shortness of breath while taking Trulicity. These may be symptoms of thyroid cancer. In studies with rats or mice, Trulicity and medicines that work like Trulicity caused thyroid tumors, including thyroid cancer. It is not known if Trulicity will cause thyroid tumors or a type of thyroid cancer called medullary thyroid carcinoma (MTC) in people. Do not take Trulicity if you or any of your family members have ever had MTC or if you have Multiple Endocrine Neoplasia syndrome type 2 (MEN 2).

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Trulicity may cause serious side effects, including:

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- **Low blood sugar (hypoglycemia).** If you are using another medicine that can cause low blood sugar (such as insulin or a sulfonylurea) while taking Trulicity, your risk for getting low blood sugar (hypoglycemia) may be higher. Signs and symptoms of low blood sugar may include dizziness, blurred vision, anxiety, irritability, mood changes, sweating, slurred speech, hunger, confusion or drowsiness, shakiness, weakness, headache, fast heartbeat, or feeling jittery. Talk to your healthcare provider about low blood sugar and how to manage it.
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- **Severe stomach problems.** Trulicity may cause stomach problems, which could be severe.

Tell your healthcare provider if you:

- have or have had problems with your pancreas, kidneys, or liver.
- have severe problems with your stomach, such as slowed emptying of your stomach (gastroparesis) or problems with digesting food.
- have any other medical conditions.
- are pregnant or plan to become pregnant, or if you become pregnant while taking Trulicity. It is not known if Trulicity will harm your unborn baby.
- are breastfeeding or plan to breastfeed. It is not known if Trulicity passes into your breast milk. You should not use Trulicity while breastfeeding without first talking to your healthcare provider.
- are taking other medicines including prescription and over-the-counter medicines, vitamins, and herbal supplements. Trulicity may affect the way some medicines work and some medicines may affect the way Trulicity works.
- are taking other medicines to treat diabetes, including insulin or sulfonylureas.

The most common side effects with Trulicity may include: nausea, diarrhea, vomiting, decreased appetite, and indigestion. Talk to your healthcare provider about any side effect that bothers you or does not go away. These are not all the possible side effects of Trulicity. Call your doctor for medical advice about side effects.

You are encouraged to report side effects of prescription drugs to the FDA. Visit www.fda.gov/medwatch or call 1-800-FDA-1088.

Please see next page for additional information about Trulicity, including Boxed Warning regarding possible thyroid tumors including thyroid cancer.

Please see Instructions for Use included with the pen.

DG CON ISI 20APR2015

Lilly

once weekly
trulicity™
(dulaglutide) injection
0.75 mg/0.5 mL, 1.5 mg/0.5 mL

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Information for Patients about Trulicity (dulaglutide):

This is a brief summary of important information about Trulicity (Trū-li-si-tee). Please read the Medication Guide that comes with Trulicity before you start taking it and each time you get a refill because there may be new information. This information is not meant to take the place of talking with your healthcare provider or pharmacist.

What is Trulicity?

Trulicity is a once-weekly, injectable prescription medicine that may improve blood sugar (glucose) in adults with type 2 diabetes mellitus, and should be used along with diet and exercise.

- It is not recommended as the first choice of medicine for treating diabetes.
- It is not known if it can be used in people who have had pancreatitis.
- It is not a substitute for insulin and is not for use in people with type 1 diabetes or people with diabetic ketoacidosis.
- It is not recommended for use in people with severe stomach or intestinal problems.
- It is not known if it can be used with long-acting insulin or if it is safe and effective for use in children under 18 years of age.

What is the most important information I should know about Trulicity?

Trulicity may cause serious side effects including possible thyroid tumors, including cancer. Tell your healthcare provider if you get a lump or swelling in your neck, hoarseness, trouble swallowing, or shortness of breath. These may be symptoms of thyroid cancer. In studies with rats or mice, Trulicity and medicines that work like Trulicity caused thyroid tumors, including thyroid cancer. It is not known if TRULICITY will cause thyroid tumors or a type of thyroid cancer called medullary thyroid carcinoma (MTC) in people.

Who should not use Trulicity?

Do not use Trulicity if:

- you or any of your family have ever had a type of thyroid cancer called medullary thyroid carcinoma (MTC) or if you have an endocrine system condition called Multiple Endocrine Neoplasia syndrome type 2 (MEN 2).
- you are allergic to dulaglutide or any of the ingredients in Trulicity.

What are the possible side effects of Trulicity?

Trulicity may cause serious side effects, including:

- **Possible thyroid tumors, including cancer**. **See** "**What is the most important information I should know about Trulicity?"**
- **inflammation of the pancreas (pancreatitis).** Stop using Trulicity and call your healthcare provider right away if you have severe pain in your stomach area (abdomen) that will not go away, with or without vomiting. You may feel the pain from your abdomen to your back.
- **low blood sugar (hypoglycemia).** Your risk for getting low blood sugar may be higher if you use Trulicity with another medicine that can cause low blood sugar such as sulfonylurea or insulin.

Signs and symptoms of low blood sugar may include: dizziness or light-headedness; blurred vision; anxiety, irritability, or mood changes; sweating; slurred speech; hunger; confusion or drowsiness; shakiness; weakness; headache; fast heartbeat; feeling jittery.

- **serious allergic reactions.** Stop using Trulicity and get medical help right away, if you have any symptoms of a serious allergic reaction including itching, rash, or difficulty breathing.
- **kidney problems (kidney failure).** In people who have kidney problems, diarrhea, nausea, and vomiting may cause a loss of fluids (dehydration) which may cause kidney problems to get worse.
- **severe stomach problems.** Other medicines like Trulicity may cause severe stomach problems. It is not known if Trulicity causes or worsens stomach problems.

The most common side effects of Trulicity may include nausea, diarrhea, vomiting, decreased appetite, indigestion.

Talk to your healthcare provider about any side effect that bothers you or does not go away. These are not all the side effects of Trulicity.

Call your doctor for medical advice about side effects. You may report side effects to FDA at 1-800-FDA-1088.

Before using Trulicity tell your healthcare provider if you:

- have had problems with your pancreas, kidneys, or liver.
- have severe problems with your stomach, such as slowed emptying of your stomach (gastroparesis) or problems digesting food.
- have any other medical conditions.
- are pregnant or plan to become pregnant, or if you become pregnant while taking Trulicity. It is not known if Trulicity will harm your unborn baby.
- are breastfeeding or plan to breastfeed. It is not known if Trulicity passes into your breast milk. You should not use Trulicity while breastfeeding without first talking to your healthcare provider.
- **are taking other medicines**—including prescription and over-the-counter medicines, vitamins, and herbal supplements. Trulicity may affect the way some medicines work and some medicines may affect the way Trulicity works.
- are taking other medicines to treat your diabetes including insulin or sulfonylureas.

Before using Trulicity, talk to your healthcare provider about low blood sugar and how to manage it.

How should I use Trulicity?

- Read the **Instructions for Use** that comes with Trulicity**.**
- Use Trulicity exactly as your healthcare provider tells you to.
- Your healthcare provider should show you how to use Trulicity before you use it for the first time.
- Trulicity is injected under the skin (subcutaneously) of your stomach (abdomen), thigh, or upper arm. **Do not** inject Trulicity into a muscle (intramuscularly) or vein (intravenously).
- **Use Trulicity 1 time each week on the same day each week at any time of the day.**
- You may change the day of the week as long as your last dose was given **3** or more days before.
- If you miss a dose of Trulicity, take the missed dose as soon as possible, if there are at least 3 days (72 hours) until your next scheduled dose. If there are less than 3 days remaining, skip the missed dose and take your next dose on the regularly scheduled day. **Do not** take **2** doses of Trulicity within **3** days of each other.
- Trulicity may be taken with or without food.
- **Do not** mix Trulicity and insulin together in the same injection.
- You may give an injection of Trulicity and insulin in the same body area (such as your stomach), but not right next to each other.
- Change (rotate) your injection site with each weekly injection. **Do not** use the same site for each injection.

Do not share your Trulicity pen, syringe, or needles with another person. You may give another person an infection or get an infection from them.

Your dose of Trulicity and other diabetes medicines may need to change because of:

- change in level of physical activity or exercise, weight gain or loss, increased stress, illness, change in diet, or because of other medicines you take.

For more information go to www.Trulicity.com or call 1-800-LillyRx (1-800-545-5979).

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Eli Lilly and Company, Indianapolis, IN 46285, USA

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Playful visitors lean in at the Tower of Pisa. The Italian campanile has defied gravity for more than 800 years.

Still Leaning

Looks like the Leaning Tower of Pisa will keep on leaning, stably, awhile longer.

More than a dozen years after major foundation work, the imperfect edifice hasn't increased its lean. In fact, civil engineer John Burland of Imperial College London says his international team has succeeded in straightening the marble bell tower by 19 inches, reducing its angle of incline by about 10 percent, and slowing its once steady creep to nearly nothing.

It wasn't easy. Built from 1173 to 1370 on silt and clay, the eight-story, 182-foot-tall tower resisted many efforts to stabilize it. What finally worked was a soil-removal process called under-excavation and the addition of wells to regulate groundwater. The chief fear now? A big earthquake. "Absent that," says Burland, "I'd be very surprised indeed if we see it lean significantly again." *—Jeremy Berlin*

GOD OF REVELRY FOUND IN ISRAEL

On a road to the ancient city of Hippos-Sussita archaeologists uncovered an intriguing—and heavy—piece of metal. A thorough cleaning revealed a one-of-a-kind find: a bronze mask, almost a foot tall, depicting Faunus, a Roman god of the forests. In the first and second centuries the mask may have been used in rituals that included sacrifices, drinking, and orgies. "It's only natural," says dig director Michael Eisenberg, "that the city preferred those to be performed outside its walls." *—A. R. Williams*



PHOTOS: MARTIN PARR, MAGNUM PHOTOS (TOP); M. EISENBERG, UNIVERSITY OF HAIFA


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Let's Go Places
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Children at Work

Not all work that children do is exploitive. But child labor is generally defined as work that children are too young to do or that harms their health, slows their development, or keeps them from school. In the past decade it has declined by nearly a third, thanks in part to global awareness.

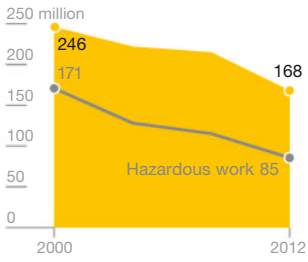
More child laborers are in agriculture than in any other sector. Most work on their families' farms, so it's not always clear where to draw the line, says the International Labour Organization's Yoshie Noguchi. Still, she warns, keeping kids in jobs instead of school could yield "an uneducated generation that can't help its country develop." —*Kelsey Nowakowski*

CHILD LABOR WORLDWIDE

1/10

OF CHILDREN AGES 5 TO 17

CHILD LABORERS



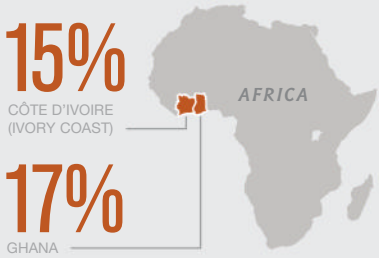
CHILDREN AND COCOA

In Ghana and Ivory Coast many cocoa farmers earn so little they can't afford to pay adult workers. Instead they rely on poorly paid or unpaid children, some of whom are brought in by traffickers from neighboring countries.

GHANA AND IVORY COAST PRODUCE HALF THE WORLD'S COCOA SUPPLY.



THE INDUSTRY EMPLOYS A LARGE SEGMENT OF THE COUNTRIES' WORKFORCES.

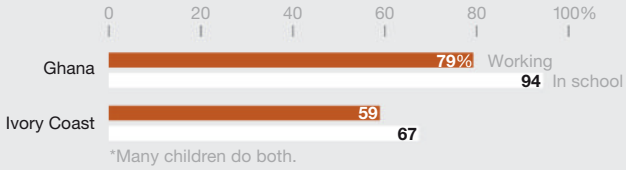


LOW-WAGE COUNTRIES Average income per day



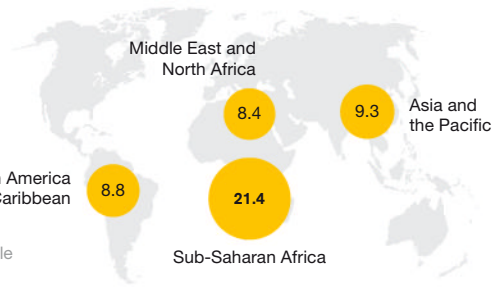
The average Ivorian and Ghanaian family has six members.

LABOR VS. STUDY* Occupation of children 5-17 years old



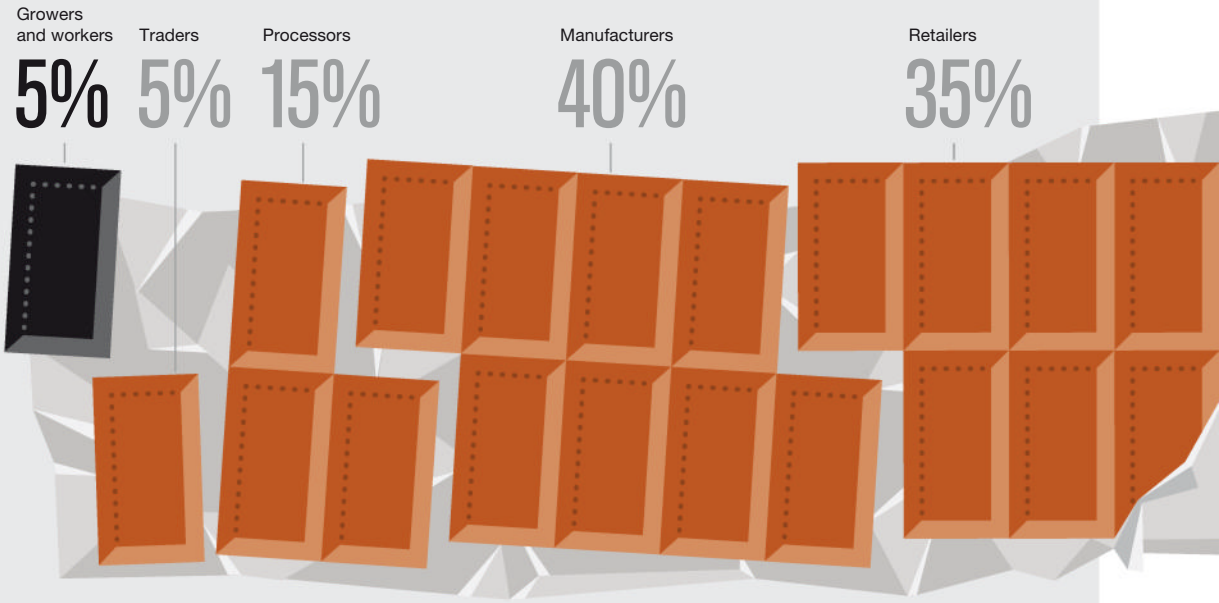
*Many children do both.

BY REGION
Percentage of children who labor



No regional data available for developed countries

THE VALUE OF A CHOCOLATE BAR Portion that goes to each sector



HAZARDS CHILDREN FACE ON A COCOA FARM



CHEMICALS
Workers often don't wear proper protection when spraying pesticides.



SHARP TOOLS
When the pods mature, workers cut them from the trees with tools such as machetes.



HEAVY LOADS
After beans are removed from their pods, they're carried to drying racks.



LONG HOURS IN THE SUN
After the beans are dry, workers pack them into sacks, then load them onto trucks.

FAMILY EMPLOYERS

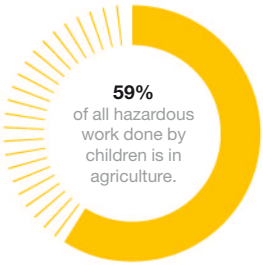
68% of child laborers are working unpaid for their families.



AGRICULTURAL SECTOR

98 million

children labor in agriculture, which includes fishery and forestry jobs.



GRAPHIC: ÁLVARO VALIÑO. SOURCES: INTERNATIONAL LABOUR ORGANIZATION; FAO; OXFORD BUSINESS GROUP; INTERNATIONAL LABOUR RIGHTS FORUM; WILLIAM BERTRAND AND ELKE DE BUHR, TULANE UNIVERSITY; FAIR TRADE ADVOCACY OFFICE



Law students at New York University take a study break with dogs brought in by volunteers.

Student Rx: Pets

On college campuses in the U.S. and around the world, pets are lending a paw to stressed-out students. With many collegians reporting depression, anxiety, and other ills—a 2013 study sponsored by the American College Counseling Association says one in three has used counseling services—school officials arrange "pet therapy" events to spread cheer and fight stress, especially during exams.

These aren't service animals trained to assist people with disabilities; most are the pets of volunteers. Their visits are demonstrably beneficial: Research shows that contact with pets can decrease blood pressure and stress-hormone levels and increase so-called happiness hormones. Mary Margaret Callahan, a director at the nonprofit Pet Partners, considers pet house calls on campus "a great way to support students in being successful." *—Lindsay N. Smith*

A JEWISH FAMILY REUNION

Of the world's ten million Ashkenazi Jews, none are more distant than 30th cousins, related to each other by multiple connections. Population geneticists traced the group back 750 years, or 30 generations, to when a small group of Ashkenazi Jews likely traveled from western Europe to Poland. "The reproducing population at that time was only around 300," says Hebrew University's Shai Carmi. Scientists think the findings could be useful in studying genetic diseases, particularly ones affecting Jews. *—Daniel Stone*

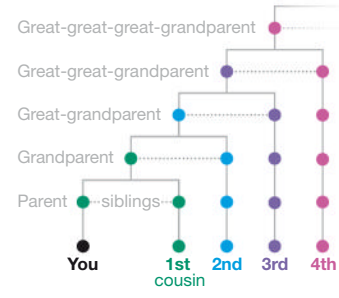


PHOTO: LANDON NORDEMAN. GRAPHIC: MATTHEW TWOMBLY, NGM STAFF

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WildernessDogFood.com

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Name, Name, Go Away

There will never be another Sandy. The thousand-mile-wide 2012 storm, which caused at least $50 billion in damage and 147 deaths, has one of 78 Atlantic hurricane names that have been retired since 1953. Rosters kept by region assign names to storms to help prevent confusion from warnings for simultaneous weather events. Names are reused in later years unless severe damage occurs (as with Sandy, above) or names become controversial—think Adolph, Israel, Isis.

Today storm names are drawn from numerous languages and cultures. In the 1970s male names were added to female-only lists. Ascribing gender may have had a surprising effect: A 2014 study from the University of Illinois at Urbana-Champaign found that people take storms with feminine names less seriously, which may put lives at risk. Critics assailed that finding, but study co-author Sharon Shavitt says her research team stands by it and continues to see it borne out.

Hurricane historian Liz Skilton questions the practice of labeling hurricanes as male or female: "We're putting sex-specific names on a thing with no biology. Can we ever move away from it?" One region already has. Most western Pacific typhoons are now named for plants or animals. *—Brad Scriber*

PHOTO: NASA

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The 500K Special Roadster is one of rarest and most-sought after automobiles ever built.

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The most ravishing model of this species was the two-seater 500K Special Roadster launched in 1936. It was a limited production cabriolet, in total less than 30 were made, adding to its near-mythical qualities. In it's day it went for top dollar—over $106,000. Today, these ultra rare masterpieces are going for millions. **In 2012, a Special Roadster fetched more than $11.7 million at auction at the Pebble Beach Concours d'Elegance.**



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Pigeons Make Flight Plans

Though their head-bobbing walk may be comical, pigeons in flight are no fools. They're urban artful dodgers, threading their way among buildings and other obstacles. David Williams and his Harvard University colleagues studied the birds' maneuvers to learn how they avoid collisions.

First Williams trained wild pigeons to fly through an empty corridor. Then he placed vertical poles at intervals in the corridor and videotaped the birds in the altered course. He expected them to use one evasive move consistently. Instead, the birds employed two moves, which researchers named: a "pause," in which the wings stalled at the top of a stroke, and a "fold," in which the wings were pulled back. Pausing was better for efficiently maintaining height, the study found, while folding helped the birds fit through narrow gaps and remain stable in a collision. *—Lindsay N. Smith*



Pigeons slow down as they approach narrow gaps, which suggests "caution or apprehension" as they decide how to proceed, researchers say.



Wing pause
More efficient



Wing fold
More stable



THIRD EYELID: A SAFER VIEW

It's called the nictitating membrane, a translucent inner eyelid good for cleansing, protecting, and many other uses. Camels rely on them during sandstorms. Frogs use them to squeeze their eyes inward, which helps with swallowing. Woodpeckers deploy them "like seat belts, so their eyes don't pop out," says Ivan Schwab, professor of ophthalmology at the University of California, Davis. A third eyelid is even found in the corner of the human eye, in a vestigial form known as the semilunar fold. *—Eve Conant*

PHOTOS: ROE ETHRIDGE, ANDREW KREPS GALLERY; JOEL SARTORE, NATIONAL GEOGRAPHIC CREATIVE (FROG)
ART: MATTHEW TWOMBLY, NGM STAFF. SOURCE: DAVID WILLIAMS

Recommended by the CDC for adults 65+



WHAT IF ONE PIECE OF KALE COULD HELP PREVENT DIABETES?

Wishful thinking, right?
But there is one step that can help protect you from another serious disease, pneumococcal pneumonia.
The PREVNAR 13® vaccine.

Over age 50? Your risk of getting pneumococcal pneumonia is higher. It's a serious disease that could put you in the hospital. Symptoms include coughing, fever, chest pain, and difficulty breathing. One dose of the PREVNAR 13® vaccine can help protect you. Even if you've already been vaccinated with another pneumonia vaccine, PREVNAR 13® may help provide additional protection. Immune response may be lower if given within one year after another pneumonia vaccine. If you are 50 or older, ask your doctor or pharmacist if PREVNAR 13® is right for you.

Prevnar 13®
Pneumococcal 13-valent Conjugate Vaccine (Diphtheria CRM_{197} Protein)

GET THIS ONE DONE.

INDICATION FOR PREVNAR 13®

- Prevnar 13® is a vaccine approved for adults 50 years of age and older for the prevention of pneumococcal pneumonia and invasive disease caused by 13 *Streptococcus pneumoniae* strains (1, 3, 4, 5, 6A, 6B, 7F, 9V, 14, 18C, 19A, 19F, and 23F)
- Prevnar 13® is not 100% effective and will only help protect against the 13 strains included in the vaccine

IMPORTANT SAFETY INFORMATION

- Prevnar 13® should not be given to anyone with a history of severe allergic reaction to any component of Prevnar 13® or any diphtheria toxoid–containing vaccine
- Adults with weakened immune systems (eg, HIV infection, leukemia) may have a reduced immune response
- In adults, immune responses to Prevnar 13® were reduced when given with injected seasonal flu vaccine
- In adults, the common side effects were pain, redness, or swelling at the injection site, limitation of arm movement, fatigue, headache, muscle pain, joint pain, decreased appetite, chills, or rash
- Ask your health care provider about the risks and benefits of Prevnar 13®. Only a health care provider can decide if Prevnar 13® is right for you

You are encouraged to report negative side effects of vaccines to the US Food and Drug Administration (FDA) and Centers for Disease Control and Prevention (CDC). Visit www.vaers.hhs.gov or call 1-800-822-7967.

Please see Important Facts for Prevnar 13® on the adjacent page.

PREVNAR 13 is a registered trademark of Wyeth LLC. Manufactured by Wyeth Pharmaceuticals Inc. Marketed by Pfizer Inc. PSA741806-02 © 2015 Pfizer Inc. All rights reserved. June 2015

Pfizer

IMPORTANT FACTS

Prevnar 13® (pronounced "Prev • nar 13")
Generic Name: Pneumococcal 13-valent Conjugate Vaccine (Diphtheria CRM_{197} Protein)

WHO SHOULD RECEIVE PREVNAR 13® (Pneumococcal 13-valent Conjugate Vaccine [Diphtheria CRM_{197} Protein])?

- Prevnar 13® is approved for adults 50 years and older for the prevention of pneumococcal pneumonia and invasive disease caused by the 13 vaccine strains
- Prevnar 13® is a vaccine also approved for children 6 weeks through 17 years of age for the prevention of invasive disease caused by the 13 strains of *Streptococcus pneumoniae* included in the vaccine, and for children 6 weeks through 5 years for the prevention of ear infections caused by 7 of the 13 strains
- Prevnar 13® is not 100% effective and will only help protect against the 13 strains included in the vaccine

Adults 50 years and older:

- A single dose of Prevnar 13® is recommended for adults aged 50 years of age and older

Children 6 weeks through 5 years of age:

- Prevnar 13® is recommended for children 6 weeks through 5 years of age
- Prevnar 13® is given as a 4-dose series at 2, 4, 6, and 12 to 15 months of age
- ***Transition schedule:*** Children who have received 1 or more doses of Prevnar® (Pneumococcal 7-valent Conjugate Vaccine [Diphtheria CRM_{197} Protein]) may complete the 4-dose immunization series with Prevnar 13®
- ***Catch-up schedule:*** Children 15 months through 5 years of age who are considered fully immunized with Prevnar® may receive 1 dose of Prevnar 13® to elicit immune responses to the 6 additional strains
- The immune responses from the transition or catch-up schedules might be lower for the 6 additional strains (types 1, 3, 5, 6A, 7F, and 19A) than if your child had received the full 4 doses of Prevnar 13®

Children 6 years through 17 years of age:

- In children 6 years through 17 years of age, Prevnar 13® is given as a single dose

WHO SHOULD NOT RECEIVE PREVNAR 13®?

Children or adults who have had a severe allergic reaction to any component of Prevnar 13® or any diphtheria toxoid–containing vaccine should not receive Prevnar 13®

BEFORE STARTING PREVNAR 13®

Tell your health care provider or your child's health care provider about all medical conditions, including:

- Previous allergic reactions to other vaccines
- Especially tell the health care provider if your child or you are taking medicines that can weaken the immune system, such as steroids (eg, prednisone) and cancer medicines, or are undergoing radiation therapy
- If you are pregnant or nursing, or if you plan to become pregnant

WARNING

- A temporary pause of breathing following vaccination has been observed in some infants born prematurely. Decisions about when to give Prevnar 13® to infants born prematurely should be based on consideration of the individual infant's medical status, and the potential benefits and possible risks of vaccination
- The safety and efficacy of Prevnar 13® when given to persons with a weakened immune system (such as HIV infection, damaged spleen, cancer, or kidney problems) is not known. Children or adults with a weakened immune system may have a reduced response to Prevnar 13®

WHAT ARE THE POTENTIAL SIDE EFFECTS?

- In adults, the common side effects were pain, redness, or swelling at the injection site, limitation of arm movement, fatigue, headache, muscle pain, joint pain, decreased appetite, chills, or rash
- The most commonly reported serious adverse events in children were bronchiolitis (an infection of the lungs) (0.9%), gastroenteritis (inflammation of the stomach and small intestine) (0.9%), and pneumonia (0.9%)
- In children 6 weeks through 17 years, the most common side effects were tenderness, redness, or swelling at the injection site, irritability, decreased appetite, decreased or increased sleep, and fever. Most commonly reported side effects in children 5 years through 17 years also included hives

WHAT SHOULD I KNOW ABOUT RECEIVING PREVNAR 13® WITH OTHER VACCINES?

- In adults, immune responses to Prevnar 13® were reduced when given with injected seasonal flu vaccine
- When given within 1 year following pneumococcal polysaccharide vaccine, immune response to Prevnar 13® may be lower

ADDITIONAL IMPORTANT INFORMATION

- The safety and effectiveness of Prevnar 13® when used in children less than 6 weeks of age is not known
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Group photo - February 2015 Egypt tour with Dr. Zahi Hawass.

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Is It Billy the Kid?



A notorious outlaw of the Wild West, Billy the Kid was notoriously camera-shy: Only one authenticated photo of him was believed to exist—until now.

Randy Guijarro bought this 4 x 5 tintype (above) at a California memorabilia shop for two dollars in 2010. When he blew it up to 50 inches wide, he saw what looks like a familiar figure (inset) in the posed croquet tableau, dated 1878.

Some prominent collectors of Old West photos say that it isn't Billy, aka William H. Bonney, and his gang of Regulators. But another vintage-photo expert, John McWilliams, says he's "hovering around 80 percent" that it is.

Guijarro has worked with a private investigator to pore over a patch of Lincoln County, New Mexico, that mirrors the photo. TV producers Jeff and Jill Aiello have performed photo matching and facial analyses, and in a "hallelujah moment" found a diary entry by Billy's friend Sallie Chisum that links everyone in the shot. If the photo goes to auction or sells privately, it could fetch a price any outlaw would love. In 2011 the sole authenticated image sold for $2.3 million. —*Jeremy Berlin*

NATIONAL GEOGRAPHIC CHANNEL

Tune in on Sunday, October 18 at 9 p.m. ET as the National Geographic Channel airs *Billy the Kid: New Evidence,* a two-hour special investigating the origin and authenticity of this tintype photograph.

PHOTO: COURTESY RANDY GUIJARRO



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Solitary, Until It's Amorous

With the notable exception of lions living in prides, most cats of the family Felidae are the wild world's Greta Garbos: They want to be alone. Adults of these roughly 40 cat species are "solitary animals that only come together to mate," according to the online encyclopedia Animal Diversity Web.

That's true of the margay (below), a smaller cousin of the ocelot. When females are in heat, every 32 to 36 days, males turn up, hang around for a couple of days, and repeatedly initiate a sex act lasting maybe one minute. Then they're gone. If a female conceives, about two and a half months later she'll bear one kitten or, rarely, two. That's convenient, as she has only one pair of mammary glands—but the low birthrate won't do much to sustain the species. After about a year offspring move out to lead their own lives of solitude.

Most nations forbid selling margays as pets or hunting them for their pelts. Centers such as Uruguay's Bioparque M'Bopicuá bolster the cat's numbers with captive breeding. Still, the International Union for Conservation of Nature warns that the species is "declining through much of its range" and that by 2025 the population could shrink as much as 30 percent. When forests are razed to become pasture and farmland, shy margays don't like crossing the changed landscapes—not even for sex. Vanishing habitat plus diminished ranks could make a solitary cat more so. *—Patricia Edmonds*

HABITAT/RANGE
Forests in Mexico and in Central and South America

CONSERVATION STATUS
Near threatened

OTHER FACTS
Hind leg joints that rotate 180 degrees allow margays to run headfirst down trees.

Male margays turn up for a few days and repeatedly initiate sex. Then they're gone.



This margay *(Leopardus wiedii)* was photographed at the Cincinnati Zoo.

PHOTO: JOEL SARTORE, NATIONAL GEOGRAPHIC CREATIVE

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VISIONS





Egypt
The Giza Pyramids, one of the Seven Wonders of the World, elicit a yawn from a camel named Alex. Built 4,500 years ago, the pharaonic tombs are marvels of architectural ingenuity. The largest comprises 2.3 million stone blocks and stands 481 feet tall.

PHOTO: CLAIRE THOMAS





Mexico
From a thousand feet above, the arid Colorado River Delta looks like a green-trunked tree with brown branches. As freshwater has dwindled over the past century—due to damming and diversion—wildlife, wetlands, agriculture, and fisheries have too.

PHOTO: EDWARD BURTYNSKY, NICHOLAS METIVIER GALLERY, TORONTO



Order prints of select *National Geographic* photos online at **NationalGeographicArt.com.**

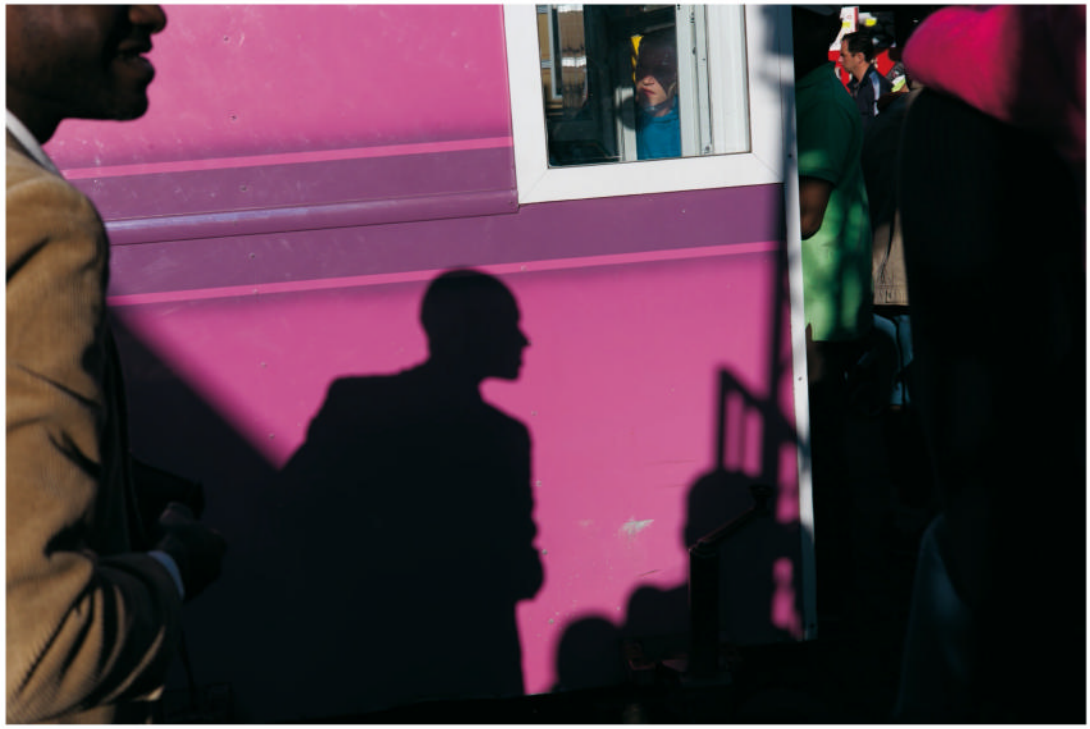


United States
As a big wave breaks off the North Shore of Oahu, Hawaii, two worlds appear. On the right, a surfer enters the barrel. On the left, submerged photographers track his progress. Heavily touristed, the North Shore is also a proving ground for local surfers.

PHOTO: SASH FITZSIMMONS

Faceless Portraits

Assignment Faces convey emotion. We challenged the Your Shot community to tell someone's story without one.



EDITOR'S NOTE

"Without the face, it's easier for us to place ourselves, our friends, or our family members into the image, into a story. It leaves room for interpretation and keeps the image mysterious."

—*Marie McGrory,* National Geographic *assistant photo editor*



Hakan Simsek
Brussels, Belgium

Simsek took his daughter to a summertime fair in Brussels. Near a ticket booth, he watched a stranger's shadow darken its pink facade. He had time to take two shots before the man moved.

Andrei Stoica
Chandler, Arizona

Stoica, a software engineer, was hiking in a remote part of Scottsdale, Arizona. Just before sunset, he noticed a boulder that made an inviting canvas. He positioned himself for a self-portrait.



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EXPLORER

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LEGEND OF THE MONKEY GOD

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Power Plant Employees and Contractors

If you or a family member ever worked at a power plant, you could have been exposed to asbestos.

To keep your right to compensation if you become ill in the future (or have asbestos-related illness today), you must submit a claim by December 14, 2015, at 5:00 p.m., prevailing Eastern Time.

Energy Future Holdings Corp., Ebasco Services, Inc., EECI, Inc. and certain subsidiaries ("EFH") owned, operated, maintained, or built certain power plants across the United States and in other countries where asbestos was present. Workers at these power plants (and family members and others who came into contact with these workers) may have been exposed to asbestos.

Anyone who has a claim today against EFH for asbestos-related illness or who may develop an asbestos-related illness in the future, must submit a claim by **December 14, 2015, at 5:00 p.m., prevailing Eastern Time** to be eligible for compensation now or in the future.

What is asbestos?

Asbestos is a fiber which was used as insulation in walls, wires, pipes, boilers, generators, steam traps, pumps, valves, electrical boards, gaskets, packing material, turbines, compressors, cement and cement pipes. Workers responsible for building and maintaining power plants and equipment also wore insulated clothing or gear that may have contained asbestos. Virtually all power plants built before 1980 used or contained asbestos-containing products.

Asbestos-related illnesses can be very serious or fatal and include diseases such as mesothelioma, lung cancer, laryngeal cancer, esophageal cancer, pharyngeal cancer, stomach cancer and asbestosis. Even if your exposure to asbestos was many years ago and you are not sick today, this notice could affect you. Asbestos-related illness can occur decades and even 50 years after the exposure to asbestos that caused the illness.

Which power plants are included?

You or a family member could have been exposed at any of the power plants related to EFH. These power plants were located across the United States and some in foreign countries. For a list of the included power plants, visit the website below or call 1-877-276-7311.

How could this affect me?

You could have been exposed to asbestos if you or a family member worked at any of the included power plants as an employee, a contractor, or in any other role. You also could have been exposed by coming in contact with another person who worked at a power plant (for example, if asbestos was brought home on your spouse or parent's clothing). You may also file a claim on behalf of a deceased family member.

What do I do now?

If you believe that you or a family member may have been exposed to asbestos at an included plant, submit a claim by **December 14, 2015, at 5:00 p.m., prevailing Eastern Time**. Go to www.EFHAsbestosClaims.com to submit your claim online. To get a paper claim form, visit the website or call 1-877-276-7311. Submitting a claim preserves your right to ask for money if you develop asbestos-related illness in the future.

You can submit a claim yourself or you can ask a lawyer to help you. If you are not ill today, completing a claim takes about five minutes.

What if I do nothing?

If you do not submit a claim and later develop asbestos-related disease, you will **not** be eligible for compensation from EFH. Even if you have not been diagnosed with disease or experienced symptoms, you must make a claim to preserve your right to compensation if you develop an asbestos-related illness in the future.

File a Claim Now

Go to www.EFHAsbestosClaims.com to file a claim online or call 1-877-276-7311 to request a claim form be sent to you.

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Tree of Life

Assignment Trees, in forms physical or figurative, hold clues to landscapes, history, and culture. We asked to see the branches in your life.



EDITOR'S NOTE

"Trees provide a place of solitude, respite, and healing. The images I chose represented, for me, unique interpretations of 'trees of life.'"

—*Erika Larsen,* National Geographic *photographer*



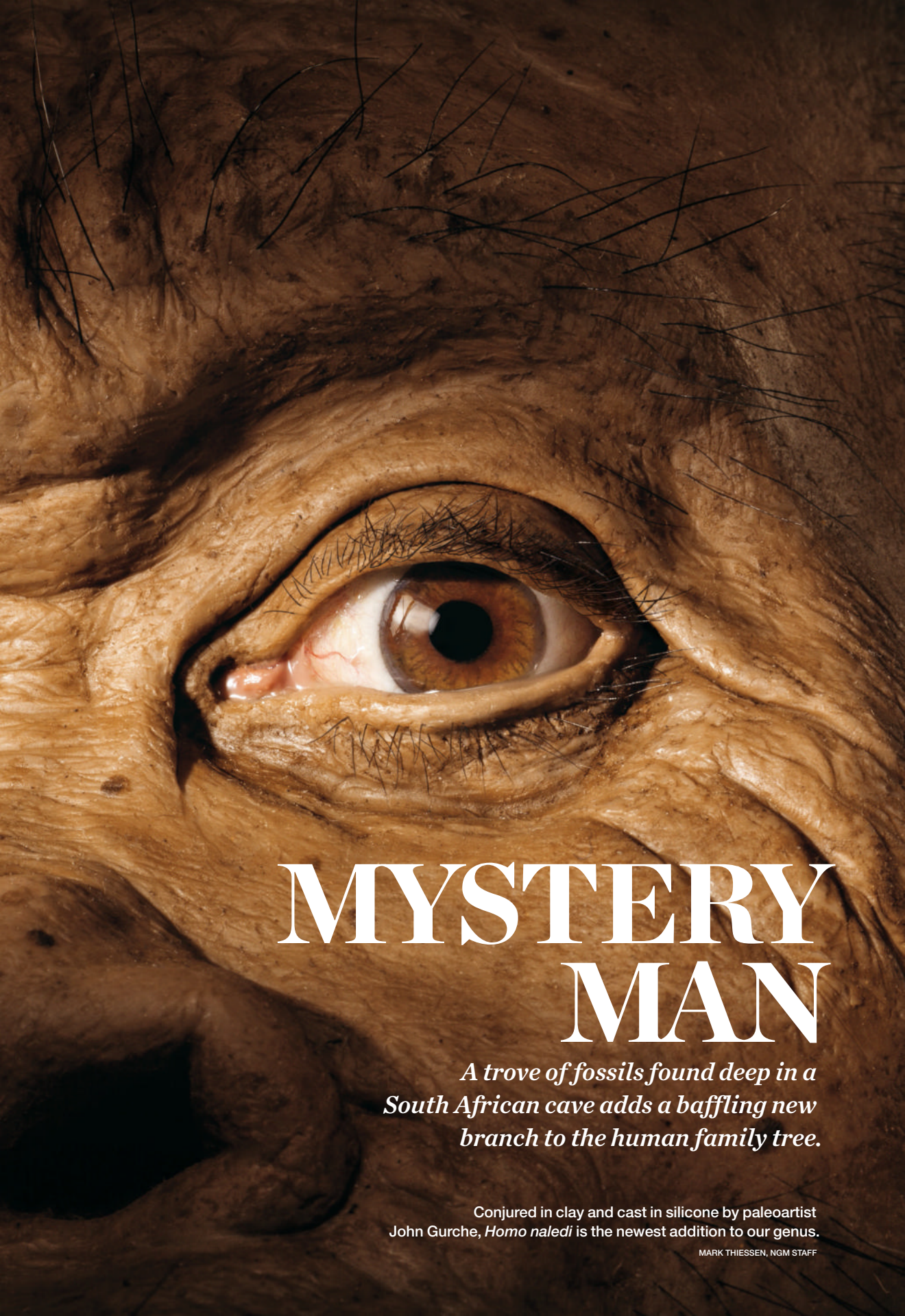
Takeshi Marumoto
Tokyo, Japan

One early morning near Japan's east coast, Marumoto, an IT consultant, visited Hitachi Seaside Park, an area known for its sea of baby blue eyes flowers in the spring. "It was a very refreshing morning," he says.

Zuzana Krajči
Bratislava, Slovakia

Krajči planned to take a classic portrait of her niece holding twigs of cherry blossoms. When she looked through the viewfinder, she noticed the framing—without the girl's face—conveyed an unintended element of mystery.





MYSTERY MAN

A trove of fossils found deep in a South African cave adds a baffling new branch to the human family tree.

Conjured in clay and cast in silicone by paleoartist John Gurche, *Homo naledi* is the newest addition to our genus.

MARK THIESSEN, NGM STAFF



Sunlight falls through the entrance of Rising Star cave, near Johannesburg. A remote chamber has yielded hundreds of fossil bones—so far. Says anthropologist Marina Elliott, seated, "We have literally just scratched the surface."





An *H. naledi* group disposes of one of their own in Rising Star cave in this artist's depiction. Though such advanced behavior is unknown in other primitive hominins, "there appears to be no other option for why the bones are there," says lead scientist Lee Berger.

ART: JON FOSTER. SOURCE: LEE BERGER, UNIVERSITY OF THE WITWATERSRAND (WITS), SOUTH AFRICA



BY JAMIE SHREEVE • PHOTOGRAPHS BY ROBERT CLARK

On September 13, 2013, two recreational cavers named Steven Tucker and Rick Hunter entered a dolomite cave system called Rising Star, some 30 miles northwest of Johannesburg. Rising Star has been a popular draw for cavers since the 1960s, and its filigree of channels and caverns is well mapped. Tucker and Hunter were hoping to find some less trodden passage.

In the back of their minds was another mission. In the first half of the 20th century, this region produced so many fossils of our early ancestors that it later became known as the Cradle of Humankind. Though the heyday of fossil hunting there was long past, the cavers knew that a scientist at the University of the Witwatersrand in Johannesburg was looking for bones. The odds of happening upon something were remote. But you never know.

Deep in the cave, Tucker and Hunter worked their way through a constriction called Superman's Crawl—because most people can fit through only by holding one arm tightly against the body and extending the other above the head, like the Man of Steel in flight. Crossing a large chamber, they climbed a jagged wall of rock called the Dragon's Back. At the top they found themselves in a pretty little cavity decorated with stalactites. Hunter got out his video camera, and to remove himself from the frame, Tucker eased himself into a fissure in the cave floor. His foot found a finger of rock, then another below it, then—empty space.

Dropping down, he found himself in a narrow, vertical chute, in some places less than eight inches wide. He called to Hunter to follow him. Both men have hyper-slender frames, all bone and wiry muscle. Had their torsos been just a little bigger, they would not have fit in the chute, and what is arguably the most astonishing human fossil discovery in half a century—and undoubtedly the most perplexing—would not have occurred.

Lee Berger, the paleoanthropologist who had asked cavers to keep an eye out for fossils, is a big-boned American with a high forehead, a flushed face, and cheeks that flare out broadly when he smiles, which is a lot of the time. His unquenchable optimism has proved essential to his professional life. By the early 1990s, when Berger got a job at the University of the Witwatersrand ("Wits") and had begun to hunt for fossils, the spotlight in human evolution had long since shifted to the Great Rift Valley of East Africa.

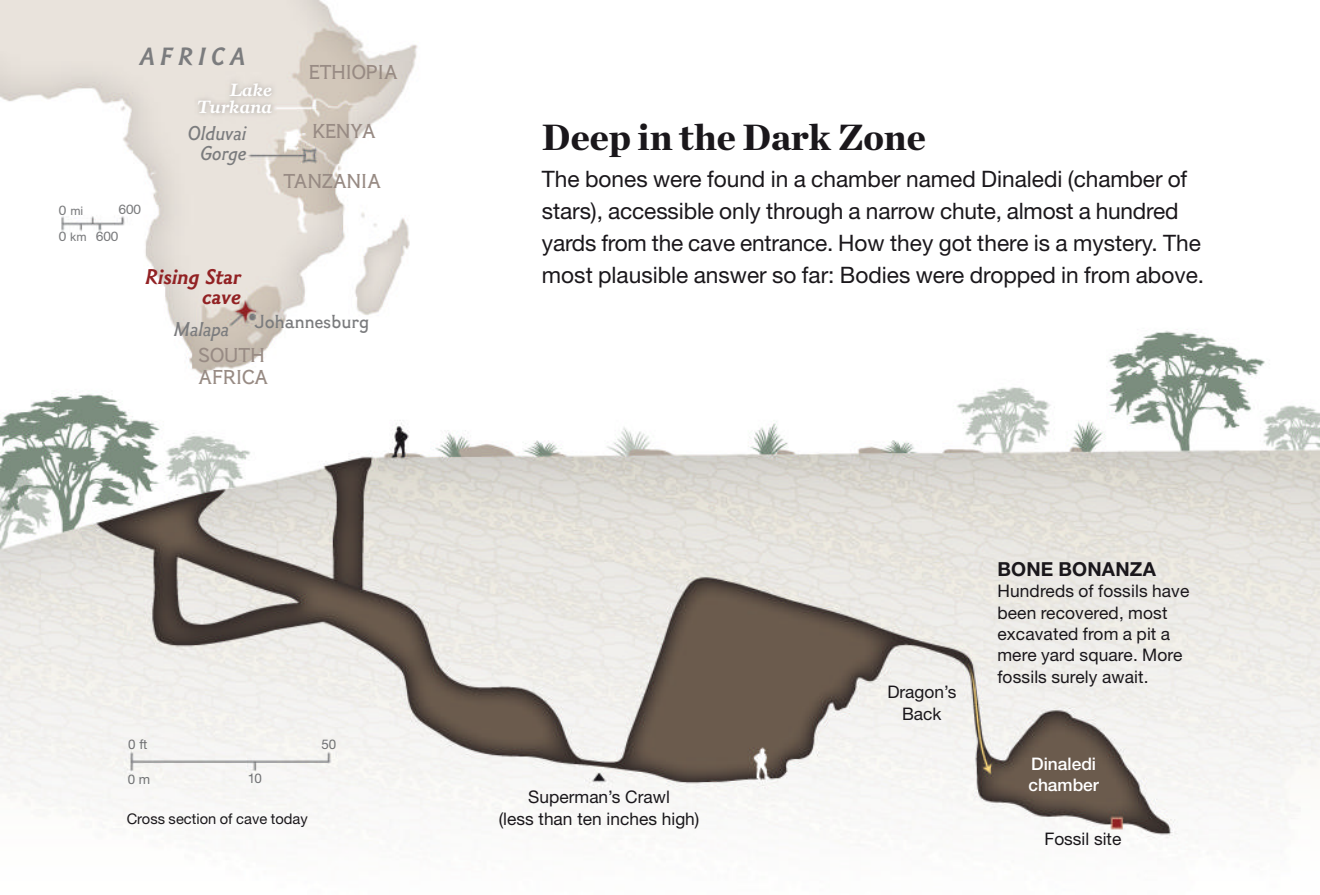
Most researchers regarded South Africa as an interesting sidebar to the story of human evolution but not the main plot. Berger was determined to prove them wrong. But for almost 20 years, the relatively insignificant finds he made seemed only to underscore how little South Africa had left to offer.

What he most wanted to find were fossils that could shed light on the primary outstanding



While primitive in some respects, the face, skull, and teeth show enough modern features to justify *H. naledi*'s placement in the genus *Homo.* Artist Gurche spent some 700 hours reconstructing the head from bone scans, using bear fur for hair.

MARK THIESSEN, NGM STAFF



Deep in the Dark Zone

The bones were found in a chamber named Dinaledi (chamber of stars), accessible only through a narrow chute, almost a hundred yards from the cave entrance. How they got there is a mystery. The most plausible answer so far: Bodies were dropped in from above.

mystery in human evolution: the origin of our genus, *Homo,* between two million and three million years ago. On the far side of that divide are the apelike australopithecines, epitomized by *Australopithecus afarensis* and its most famous representative, Lucy, a skeleton discovered in Ethiopia in 1974. On the near side is *Homo erectus,* a tool-wielding, fire-making, globe-trotting species with a big brain and body proportions much like ours. Within that murky million-year gap, a bipedal animal was transformed into a nascent human being, a creature not just adapted to its environment but able to apply its mind to master it. How did that revolution happen?

The fossil record is frustratingly ambiguous. Slightly older than *H. erectus* is a species called *Homo habilis,* or "handy man"—so named by Louis Leakey and his colleagues in 1964 because they believed it responsible for the stone tools they were finding at Olduvai Gorge in Tanzania. In the 1970s teams led by Louis's son Richard found more *H. habilis* specimens in Kenya, and ever since, the species has provided a shaky base for the human family tree, keeping it rooted in East Africa. Before *H. habilis* the human story goes dark, with just a few fossil fragments of *Homo* too sketchy to warrant a species name. As one scientist put it, they would easily fit in a shoe box, and you'd still have room for the shoes.

Berger has long argued that *H. habilis* was too primitive to deserve its privileged position at the root of our genus. Some other scientists agree that it really should be called *Australopithecus.* But Berger has been nearly alone in arguing that South Africa was the place to look for the true earliest *Homo.* And for years the unchecked exuberance with which he promoted his relatively minor finds tended only to alienate some of his professional colleagues. Berger had the ambition and personality to become a famous player in his field, like Richard Leakey or Donald Johanson, who found the Lucy skeleton. Berger is a tireless fund-raiser and a master at enthralling a public audience. But he didn't have the bones.

Then, in 2008, he made a truly important discovery. While searching in a place later called Malapa, some ten miles from Rising Star, he and his 14-year-old son, Matthew, found some hominin fossils poking out of hunks of dolomite.

Over the next year Berger's team painstakingly chipped two nearly complete skeletons out of the rock. Dated to about two million years ago, they were the first major finds from South Africa published in decades. (An even more complete

JASON TREAT, NGM STAFF. NGM MAPS. SOURCE: LEE BERGER, WITS

skeleton found earlier has yet to be described.) In most respects they were very primitive, but there were some oddly modern traits too.

Berger decided the skeletons were a new species of australopithecine, which he named *Australopithecus sediba.* But he also claimed they were "the Rosetta stone" to the origins of *Homo.* Though the doyens of paleoanthropology credited him with a "jaw-dropping" find, most dismissed his interpretation of it. *A. sediba* was too young, too weird, and not in the right place to be ancestral to *Homo:* It wasn't one of us. In another sense, neither was Berger. Since then, prominent researchers have published papers on early *Homo* that didn't even mention him or his find.

Berger shook off the rejection and got back to work—there were additional skeletons from Malapa to occupy him, still encased in limestone blocks in his lab. Then one night, Pedro Boshoff, a caver and geologist Berger had hired to look for fossils, knocked on his door. With him was Steven Tucker. Berger took one look at the pictures they showed him from Rising Star and realized that Malapa was going to have to take a backseat.

After contorting themselves 40 feet down the narrow chute in the Rising Star cave, Tucker and Rick Hunter had dropped into another pretty chamber, with a cascade of white flowstones in one corner. A passageway led into a larger cavity, about 30 feet long and only a few feet wide, its walls and ceiling a bewilderment of calcite gnarls and jutting flowstone fingers. But it was what was on the floor that drew the two men's attention. There were bones everywhere. The cavers first thought they must be modern. They weren't stone heavy, like most fossils, nor were they encased in stone—they were just lying about on the surface, as if someone had tossed them in. They noticed a piece of a lower jaw, with teeth intact; it looked human.

Berger could see from the photos that the bones did not belong to a modern human being. Certain features, especially those of the jawbone and teeth, were far too primitive. The photos showed more bones waiting to be found; Berger could make out the outline of a partly buried cranium. It seemed likely that the remains represented much of a complete skeleton. He was dumbfounded. In the early hominin fossil record, the number of mostly complete skeletons, including his two from Malapa, could be counted on one hand. And now this. But what *was* this? How old was it? And how did it get into that cave?

"Looking down into the chute, I wasn't sure I'd be OK. It was like looking into a shark's mouth. There were fingers and tongues and teeth of rock."
—Marina Elliott, anthropologist

Most pressing of all: how to get it out again, and quickly, before some other amateurs found their way into that chamber. (It was clear from the arrangement of the bones that someone had already been there, perhaps decades before.) Tucker and Hunter lacked the skills needed to excavate the fossils, and no scientist Berger knew—certainly not himself—had the physique to squeeze through that chute. So Berger put the word out on Facebook: Skinny individuals wanted, with scientific credentials and caving experience; must be "willing to work in cramped quarters." Within a week and a half he'd heard from nearly 60 applicants. He chose the six most qualified; all were young women. Berger called them his "underground astronauts."

With funding from National Geographic (Berger is also a National Geographic explorer-in-residence), he gathered some 60 scientists and set up an aboveground command center, a science tent, and a small village of sleeping and support tents. Local cavers helped thread two miles of communication and power cables down into the fossil chamber. Whatever was happening there could now be viewed with cameras by Berger and his team in the command center. Marina Elliott, then a graduate student at Simon Fraser University in British Columbia, was the first scientist down the chute.

"Looking down into it, I wasn't sure I'd be



Elliott (at left) explores a side chamber with paleontologist Ashley Kruger. Elliott was one of six scientists on the expedition with the skill and physique to reach the Dinaledi chamber. Lee Berger, on screen, follows progress from the surface.

ELLIOT ROSS



There were bones everywhere, just lying about on the surface. The cavers noticed a piece of a lower jaw, with teeth intact.

OK," Elliott recalled. "It was like looking into a shark's mouth. There were fingers and tongues and teeth of rock."

Elliott and two colleagues, Becca Peixotto and Hannah Morris, inched their way to the "landing zone" at the bottom, then crouched into the fossil chamber. Working in two-hour shifts with another three-woman crew, they plotted and bagged more than 400 fossils on the surface, then started carefully removing soil around the half-buried skull. There were other bones beneath and around it, densely packed. Over the next several days, while the women probed a square-yard patch around the skull, the other scientists huddled around the video feed in the command center above in a state of near-constant excitement. Berger, dressed in field khakis and a Rising Star Expedition cap, would occasionally repair to the science tent to puzzle over the accumulating bones—until a collective howl of astonishment from the command center brought him rushing back to witness another discovery. It was a glorious time.

The bones were superbly preserved, and from the duplication of body parts, it soon became clear that there was not one skeleton in the cave, but two, then three, then five…then so many it was hard to keep a clear count. Berger had allotted three weeks for the excavation. By the end of that time, the excavators had removed some 1,200 bones, more than from any other human ancestor site in Africa—and they still hadn't exhausted the material in just the one square yard around the skull. It took another several days digging in March 2014 before its sediments ran dry, about six inches down.

There were some 1,550 specimens in all, representing at least 15 individuals. Skulls. Jaws. Ribs. Dozens of teeth. A nearly complete foot. A hand, virtually every bone intact, arranged as in life. Minuscule bones of the inner ear. Elderly adults. Juveniles. Infants, identified by their thimble-size vertebrae. Parts of the skeletons looked astonishingly modern. But others were just as astonishingly primitive—in some cases, even more apelike than the australopithecines.

"We've found a most remarkable creature," Berger said. His grin went nearly to his ears.

In paleoanthropology, newly discovered specimens are traditionally held close to the vest until they can be carefully analyzed and the results published, with full access to them granted only to the discoverer's closest collaborators. By this protocol, answering the central mystery of the Rising Star find—*What is it?*—could take years, even decades. Berger wanted the work done and published by the end of the year. In his view everyone in the field should have access to important new information as quickly as possible. And maybe he liked the idea of announcing his find, which might be a new candidate for earliest *Homo,* in 2014—exactly 50 years after Louis Leakey published his discovery of the reigning first member of our genus, *Homo habilis.*

In any case there was only one way to get the analysis done quickly: Put a lot of eyes on the bones. Along with the 20-odd senior scientists who had helped him evaluate the Malapa skeletons, Berger invited more than 30 young scientists, some with the ink still wet on their Ph.D.'s, to Johannesburg from some 15 countries, for a blitzkrieg fossil fest lasting six weeks. To some older scientists who weren't involved, putting young people on the front line just to rush the papers into print seemed rash. But for the young people in question, it was "a paleofantasy come true," said Lucas Delezene, a newly appointed professor at the University of Arkansas. "In grad school you dream of a pile of fossils no one has seen before, and you get to figure it out."

Support for this project was provided by the Lyda Hill Foundation and your Society membership.



With other team members, Berger, Elliott, and Kruger (foreground, from left) view the first images from the fossil chamber. Steve Tucker (far right) co-discovered the site. K. Lindsay Hunter and Alia Gurtov (back left) helped excavate the bones.

The workshop took place in a newly constructed vault at Wits, a windowless room lined with glass-paneled shelves bearing fossils and casts. The analytical teams were divided by body part. The cranial specialists huddled in one corner around a large square table that was covered with skull and jaw fragments and the casts of other well-known fossil skulls. Smaller tables were devoted to hands, feet, long bones, and so on. The air was cool, the atmosphere hushed. Young scientists fiddled with bones and calipers. Berger and his close advisers circulated among them, conferring in low voices.

Delezene's own fossil pile contained 190 teeth—a critical part of any analysis, since teeth alone are often enough to identify a species. But these teeth weren't like anything the scientists in the "tooth booth" had ever seen. Some features were astonishingly humanlike—the molar crowns were small, for instance, with five cusps like ours. But the premolar roots were weirdly primitive. "We're not sure what to make of these," Delezene said. "It's crazy."

The same schizoid pattern was popping up at the other tables. A fully modern hand sported wackily curved fingers, fit for a creature climbing trees. The shoulders were apish too, and the widely flaring blades of the pelvis were as primitive as Lucy's—but the bottom of the same pelvis looked like a modern human's. The leg bones started out shaped like an australopithecine's but gathered modernity as they descended toward the ground. The feet were virtually indistinguishable from our own.

"You could almost draw a line through the hips—primitive above, modern below," said Steve Churchill, a paleontologist from Duke University. "If you'd found the foot by itself, you'd think some Bushman had died."

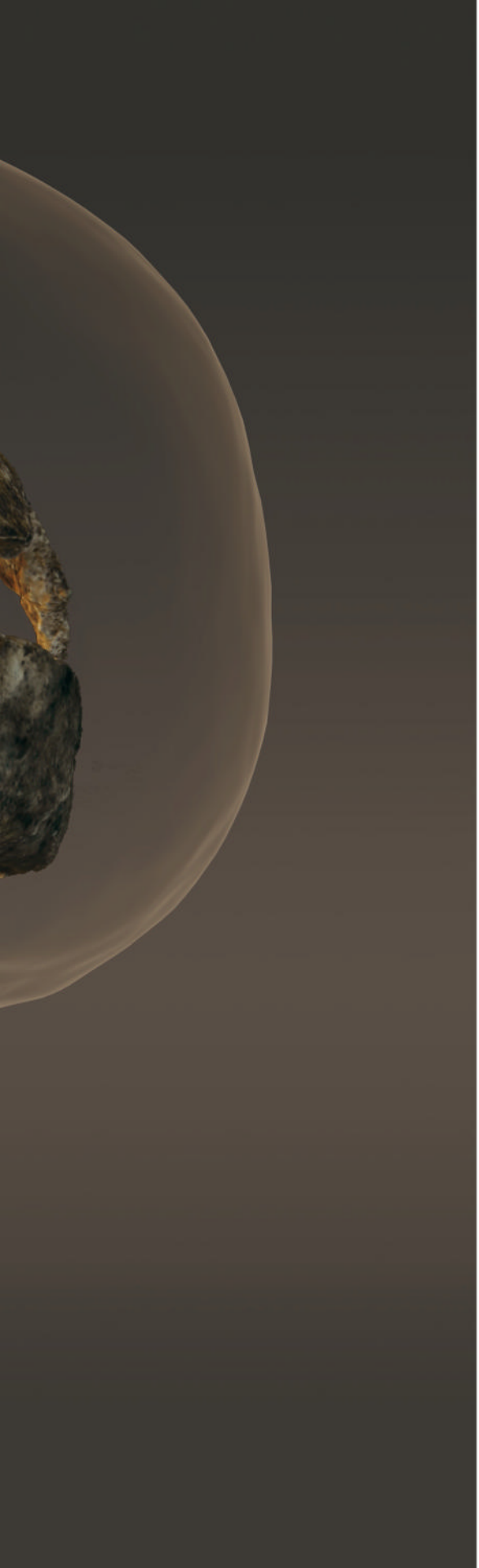
But then there was the head. Four partial skulls had been found—two were likely male, two female. In their general morphology they clearly looked advanced enough to be called *Homo*. But the braincases were tiny—a mere 560 cubic centimeters for the males and 465 for the females, far less than *H. erectus*'s average of 900 cubic centimeters, and well under half the size of our own. A large brain is the sine qua non

RACHELLE KEELING



The braincase of this composite male skull of *H. naledi,* shown actual size, measures a mere 560 cubic centimeters in volume—less than half that of the modern human skull behind it. Female braincases were even smaller.

ART: STEFAN FICHTEL. SOURCES: LEE BERGER AND PETER SCHMID, WITS; JOHN HAWKS, UNIVERSITY OF WISCONSIN-MADISON



"Tiny little brains stuck on these bodies that weren't tiny. Weird as hell."
—Fred Grine, paleoanthropologist

"We've found a most remarkable creature."
—Lee Berger, paleoanthropologist

of humanness, the hallmark of a species that has evolved to live by its wits. These were not human beings. These were pinheads, with some humanlike body parts.

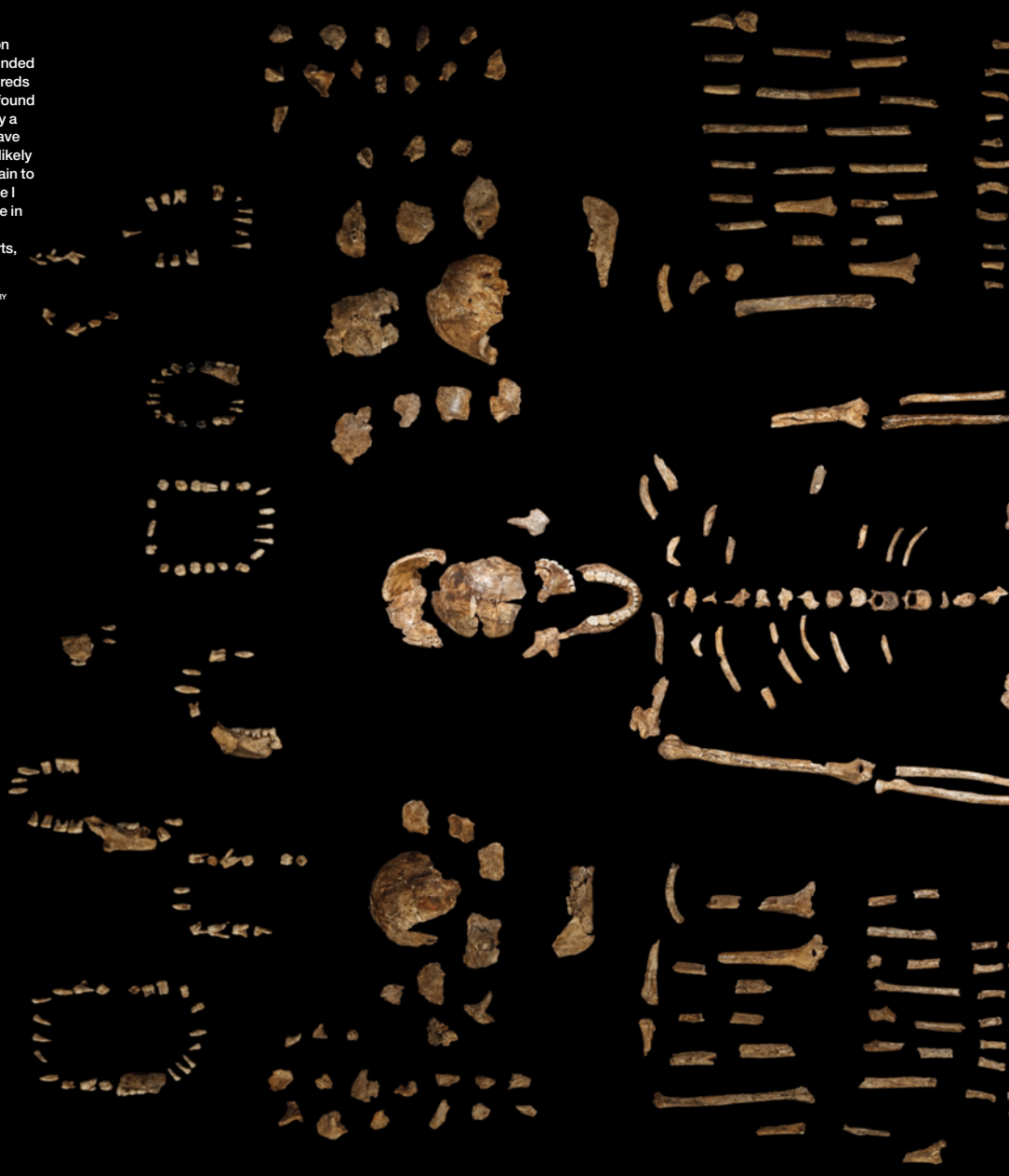
"Weird as hell," paleoanthropologist Fred Grine of the State University of New York at Stony Brook later said. "Tiny little brains stuck on these bodies that weren't tiny." The adult males were around five feet tall and a hundred pounds, the females a little shorter and lighter.

"The message we're getting is of an animal right on the cusp of the transition from *Australopithecus* to *Homo,"* Berger said as the workshop began to wind down in early June. "Everything that is touching the world in a critical way is like us. The other parts retain bits of their primitive past."

In some ways the new hominin from Rising Star was even closer to modern humans than *Homo erectus* is. To Berger and his team, it clearly belonged in the *Homo* genus, but it was unlike any other member. They had no choice but to name a new species. They called it *Homo naledi,* tipping a hat to the cave where the bones had been found: In the local Sotho language, *naledi* means "star."

Back in November, as Marina Elliott and her mates were uncovering that startling trove of bones, they were almost as surprised by what they weren't finding. "It was day three or four, and we still hadn't found any fauna," Elliott said. On the first day a few little bird bones had been found on the surface, but otherwise there was nothing but hominin bones.

That made for a mystery as perplexing as that of *H. naledi*'s identity: How did the remains get



A composite skeleton of *H. naledi* is surrounded by some of the hundreds of other specimens found in the cave. With only a square yard of the cave floor excavated, it's likely that many more remain to be found. "Every time I stuck my pocketknife in the sediment," says geologist Eric Roberts, "I hit bone."

SOURCE: LEE BERGER, WITS PHOTOGRAPHED AT EVOLUTIONARY STUDIES INSTITUTE



The Sum of Its Parts

A composite skeleton reveals *H. naledi*'s overall body plan. Its shoulders, hips, and torso hark back to earlier ancestors, while its lower body shows more humanlike adaptations. The skull and teeth show a mix of traits.

***HOMO* FEATURES**

Humanesque skull
The general shape of *H. naledi*'s skull is advanced, though the braincase is less than half that of a modern human's.

AUSTRALOPITHECINE FEATURES

Primitive shoulders
H. naledi's shoulders are positioned in a way that would have helped with climbing and hanging.

Flared pelvis
The hip bones of *H. naledi* flare outward—a primitive trait—and are shorter front to back than those of modern humans.

Versatile hands
H. naledi's palms, wrists, and thumbs are humanlike, suggesting tool use.

Curved fingers
Long, curved fingers, useful for climbing in trees, could be a trait retained from a more apelike ancestor.

Long legs
The leg bones are long and slender and have the strong muscle attachments characteristic of a modern bipedal gait.

Humanlike feet
Except for the slightly curved toes, *H. naledi*'s feet are nearly indistinguishable from ours, with arches that suggest an efficient long-distance stride.

SKELETON: STEFAN FICHTEL

BODY COMPARISON PAINTING: JOHN GURCHE

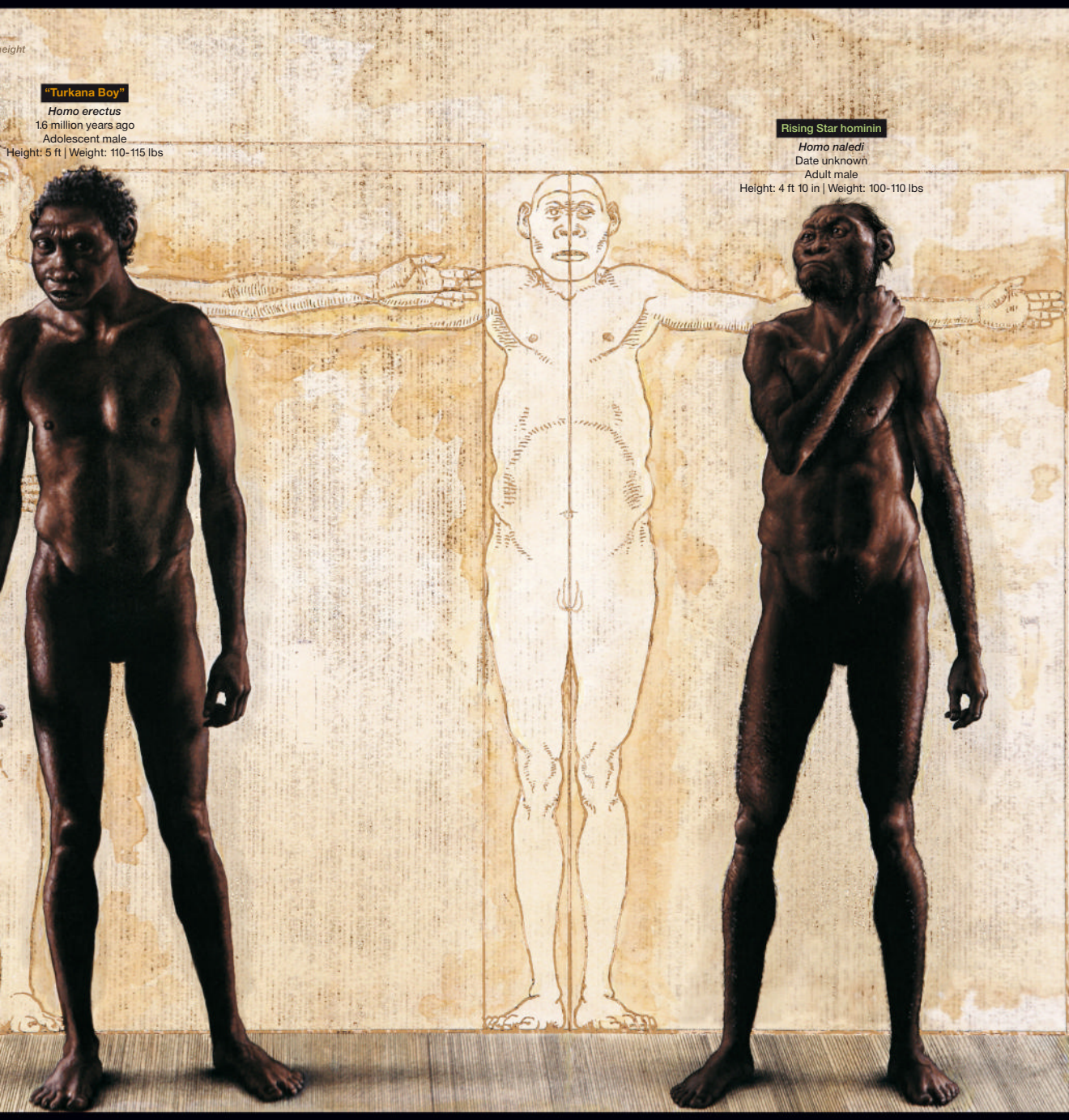
SOURCES: LEE BERGER AND PETER SCHMID, WITS; JOHN HAWKS, UNIVERSITY OF WISCONSIN-MADISON

A New Kind of Ancestor

H. naledi was much closer in appearance to *Homo* species such as *H. erectus* than to australopithecines, such as Lucy. But it possesses enough traits shared with no other member of our genus that it warrants a new species name.

Projected adult *H*

"Lucy"
Australopithecus afarensis
3.2 million years ago
Adult female
Height: 3 ft 8 in | Weight: 60-65 lbs


eight
"Turkana Boy"
Homo erectus
1.6 million years ago
Adolescent male
Height: 5 ft | Weight: 110-115 lbs
Rising Star hominin
Homo naledi
Date unknown
Adult male
Height: 4 ft 10 in | Weight: 100-110 lbs



Assembled from 3-D scans of individual fossils, a life-size rendering of *H. naledi*'s hand displays curved fingers, a clue that the species had retained an ability to climb in trees and on rocks. The thumb, wrist, and palm bones all look remarkably modern.

ART: STEFAN FICHTEL. SOURCES: LEE BERGER AND PETER SCHMID, WITS; JOHN HAWKS, UNIVERSITY OF WISCONSIN-MADISON

into such an absurdly remote chamber? Clearly the individuals weren't living in the cave; there were no stone tools or remains of meals to suggest such occupation. Conceivably a group of *H. naledi* could have wandered into the cave one time and somehow got trapped—but the distribution of the bones seemed to indicate that they had been deposited over a long time, perhaps centuries. If carnivores had dragged hominin prey into the cave, they would have left tooth marks on the bones, and there weren't any. And finally, if the bones had been washed into the cave by flowing water, it would have carried stones and other rubble there too. But there is no rubble—only fine sediment that had weathered off the walls of the cave or sifted through tiny cracks.

"When you have eliminated the impossible," Sherlock Holmes once reminded his friend Watson, "whatever remains, however improbable, must be the truth."

Having exhausted all other explanations, Berger and his team were stuck with the improbable conclusion that bodies of *H. naledi* were deliberately *put* there, by other *H. naledi.* Until now only *Homo sapiens,* and possibly some archaic humans such as the Neanderthals, are known to have treated their dead in such a ritualized manner. The researchers don't argue that these much more primitive hominins navigated Superman's Crawl and the harrowing shark-mouth chute while dragging corpses behind them—that would go beyond improbable to incredible. Maybe back then Superman's Crawl was wide enough to be walkable, and maybe the hominins simply dropped their burden into the chute without climbing down themselves. Over time the growing pile of bones might have slowly tumbled into the neighboring chamber.

Deliberate disposal of bodies would still have required the hominins to find their way to the top of the chute through pitch-black darkness and back again, which almost surely would have required light—torches, or fires lit at intervals. The notion of such a small-brained creature exhibiting such complex behavior seems so unlikely that many other researchers have simply refused to credit it. At some earlier time, they argue, there must have been an entrance to the cave that afforded more direct access to the fossil chamber—one that probably allowed the bones to wash in. "There has to be another entrance," Richard Leakey said after he'd paid a visit to Johannesburg to see the fossils. "Lee just hasn't found it yet."

Disposal of the dead brings closure for the living and confers respect. Such sentiments are a hallmark of humanity. But *H. naledi* was not human.

But water would inevitably have washed rubble, plant material, and other debris into the fossil chamber along with the bones, and they simply aren't there. "There isn't a lot of subjectivity here," said Eric Roberts, a geologist from James Cook University in Australia, svelte enough to have examined the chamber himself. "The sediments don't lie."

Disposal of the dead brings closure for the living, confers respect on the departed, or abets their transition to the next life. Such sentiments are a hallmark of humanity. But *H. naledi,* Berger emphatically stresses, was *not* human—which makes the behavior all the more intriguing.

"It's an animal that appears to have had the cognitive ability to recognize its separation from nature," he said.

The mysteries of what *H. naledi* is, and how its bones got into the cave, are inextricably knotted with the question of how old those bones are—and for the moment no one knows. In East Africa, fossils can be accurately dated when they are found above or below layers of volcanic ash, whose age can be measured from the clocklike decay of radioactive elements in the ash. At Malapa, Berger had gotten lucky: The *A. sediba* bones lay between two flowstones—thin layers of calcite deposited by running water—that could also be dated radiometrically. But the bones in the Rising Star



A trio of other *Homo* species, all first appearing in the fossil record around two million years ago, argues against a linear progression toward humanness—a message underscored by *H. naledi*'s unique blend of primitive and advanced traits.

IMAGES NOT TO SCALE

chamber were just lying on the cave floor or buried in shallow, mixed sediments. *When* they got into the cave is an even more intractable problem to solve than *how*.

Most of the workshop scientists fretted over how their analysis would be received without a date attached. (As it turned out, the lack of a date would prove to be one impediment to a quick publication of the scientific papers describing the finds.) But Berger wasn't bothered one bit. If *H. naledi* eventually proved to be as old as its morphology suggested, then he had quite possibly found the root of the *Homo* family tree. But if the new species turned out to be much younger, the repercussions could be equally profound. It could mean that while our own species was evolving, a separate, small-brained, more primitive-looking *Homo* was loose on the landscape, as recently as anyone dared to contemplate. A hundred thousand years ago? Fifty thousand? Ten thousand? As the exhilarating workshop came to an end with that fundamental question still unresolved, Berger was sanguine as always. "No matter what the age, it will have tremendous impact," he said, shrugging.

A few weeks later, in August of last year, he traveled to East Africa. To mark the occasion of the 50th anniversary of Louis Leakey's description of *H. habilis,* Richard Leakey had summoned the leading thinkers on early human evolution to a symposium at the Turkana Basin Institute, the research center he (along with the State University of New York at Stony Brook) had established near the western shore of Lake Turkana in Kenya.

The purpose of the meeting was to try to come to some consensus over the confounding record of early *Homo,* without grandstanding or rancor—two vices endemic to paleoanthropology. Some of Lee Berger's harshest critics would be there, including some who'd written scathing reviews of his interpretation of the *A. sediba* fossils. To them, he was an outsider at best, a hype artist at worst. Some threatened not to attend if he were there. But given the Rising Star discovery, Leakey could hardly not invite him.

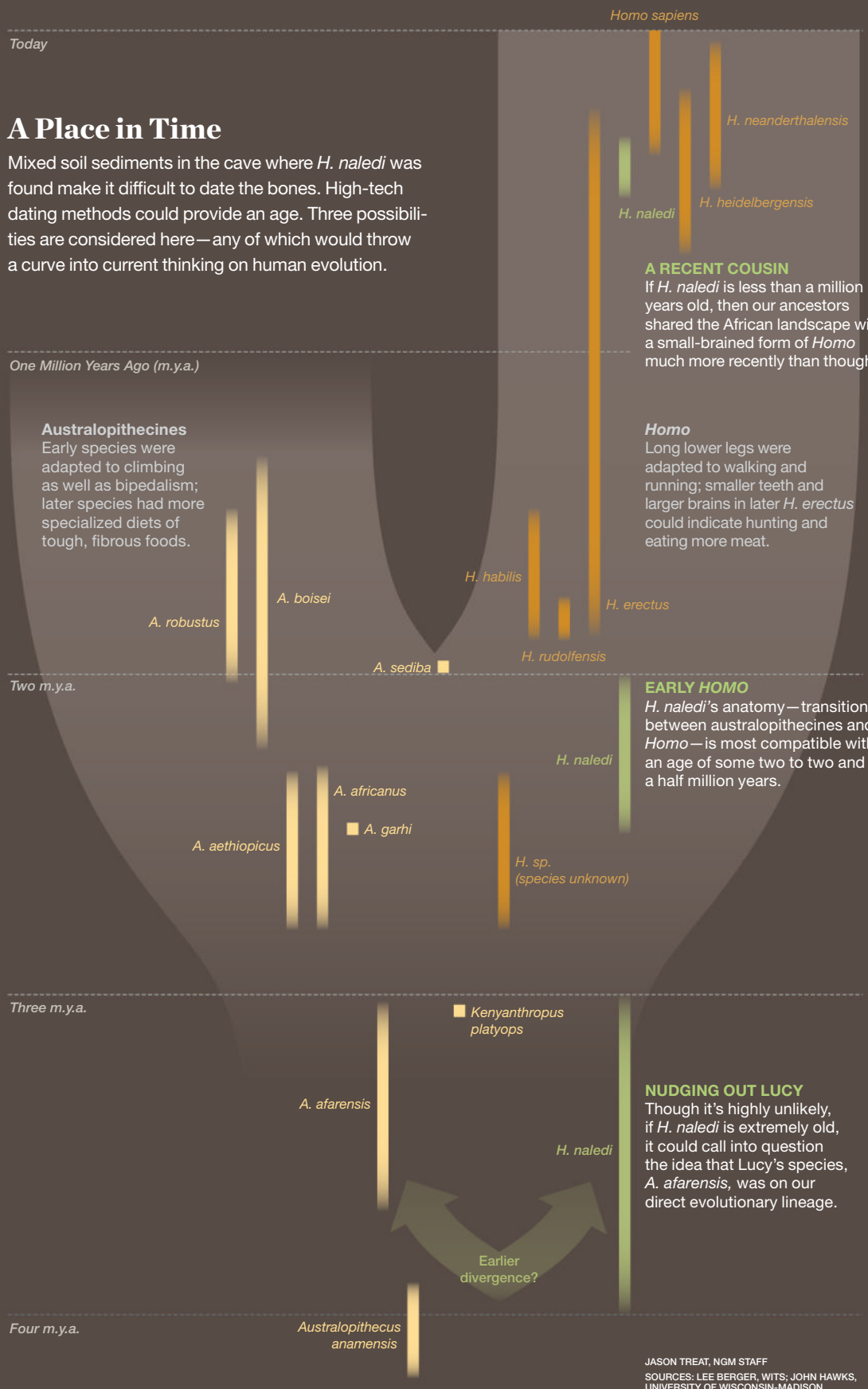
"There's no one on Earth finding fossils like Lee is now," Leakey said.

For four days the scientists huddled together in a spacious lab room, its casement windows open to the breezes, casts of all the important evidence for early *Homo* spread out on tables. One morning Meave Leakey (who's also a National Geographic explorer-in-residence) opened a vault to reveal brand-new specimens found on the east side of the lake, including a nearly complete foot. When it was his turn to speak, Bill Kimbel of the Institute of Human Origins described a new *Homo* jaw from Ethiopia dated to 2.8 million years ago—the oldest member of our genus yet. Archaeologist Sonia Harmand of

RECONSTRUCTIONS: JOHN GURCHE

A Place in Time

Mixed soil sediments in the cave where *H. naledi* was found make it difficult to date the bones. High-tech dating methods could provide an age. Three possibilities are considered here—any of which would throw a curve into current thinking on human evolution.



JASON TREAT, NGM STAFF

SOURCES: LEE BERGER, WITS; JOHN HAWKS, UNIVERSITY OF WISCONSIN-MADISON

"What *naledi* says to me is that you may think the fossil record is complete enough to make up stories, and it's not."
—Fred Grine

Stony Brook University dropped an even bigger bombshell—the discovery of dozens of crude stone tools near Lake Turkana dating to 3.3 million years ago. If stone tools originated half a million years *before* the first appearance of our genus, it would be hard to argue anymore that the defining characteristic of *Homo* was its technological ingenuity.

Berger meanwhile was uncommonly subdued, adding little to the discussion, until the topic turned to a comparison of *A. sediba* and *H. habilis.* It was time.

"More of interest perhaps to this debate is Rising Star," he offered. For the next 20 minutes he laid out all that had happened—the serendipitous discovery of the cave, the crash analysis in June, and the gist of its findings. While he talked, a couple of casts of Rising Star skulls were passed hand to hand.

Then came the questions. Have you done a cranio-dental analysis? Yes. The *H. naledi* skull and teeth place it in a group with *Homo erectus,* Neanderthals, and modern humans. Closer to *H. erectus* than *H. habilis* is? Yes. Are there any tooth marks on the bones from carnivores? No, these are the healthiest dead individuals you'll ever see. Have you made progress on the dating? Not yet. We'll get a date sometime. Don't worry.

Then, when the questions were over, the gathered doyens did something no one expected, least of all Berger. They applauded.

When a major new find is made in human evolution—or even a minor new find—it's common to claim it overturns all previous notions of our ancestry. Perhaps having learned from past mistakes, Berger doesn't make such assertions for *Homo naledi*—at least not yet, with its place in time uncertain. He doesn't claim he has found the earliest *Homo,* or that his fossils return the title of "Cradle of Humankind" from East to South Africa. The fossils do suggest, however, that both regions, and everywhere in between, may harbor clues to a story that is more complicated than the metaphor "human family tree" would suggest.

"What *naledi* says to me is that you may think the record is complete enough to make up stories, and it's not," said Stony Brook's Fred Grine. Maybe early species of *Homo* emerged in South Africa and then moved up to East Africa. "Or maybe it's the other way around."

Berger himself thinks the right metaphor for human evolution, instead of a tree branching from a single root, is a braided stream: a river that divides into channels, only to merge again downstream. Similarly, the various hominin types that inhabited the landscapes of Africa must at some point have diverged from a common ancestor. But then farther down the river of time they may have coalesced again, so that we, at the river's mouth, carry in us today a bit of East Africa, a bit of South Africa, and a whole lot of history we have no notion of whatsoever. Because one thing is for sure: If we learned about a completely new form of hominin only because a couple of cavers were skinny enough to fit through a crack in a well-explored South African cave, we really don't have a clue what else might be out there. ▯


GARRETH BIRD

Video: Meet the Cave Women
Out of 60 applicants, six intrepid women were picked to explore the Dinaledi chamber—a job that gives new meaning to "working in cramped quarters." Go to *ngm.com/more.*


COURTESY NG STUDIOS

From Ape to Human
Dawn of Humanity, a two-hour National Geographic/NOVA special, chronicles the discovery of *Homo naledi*. Tune in to your PBS station September 16 at 9 p.m. ET.

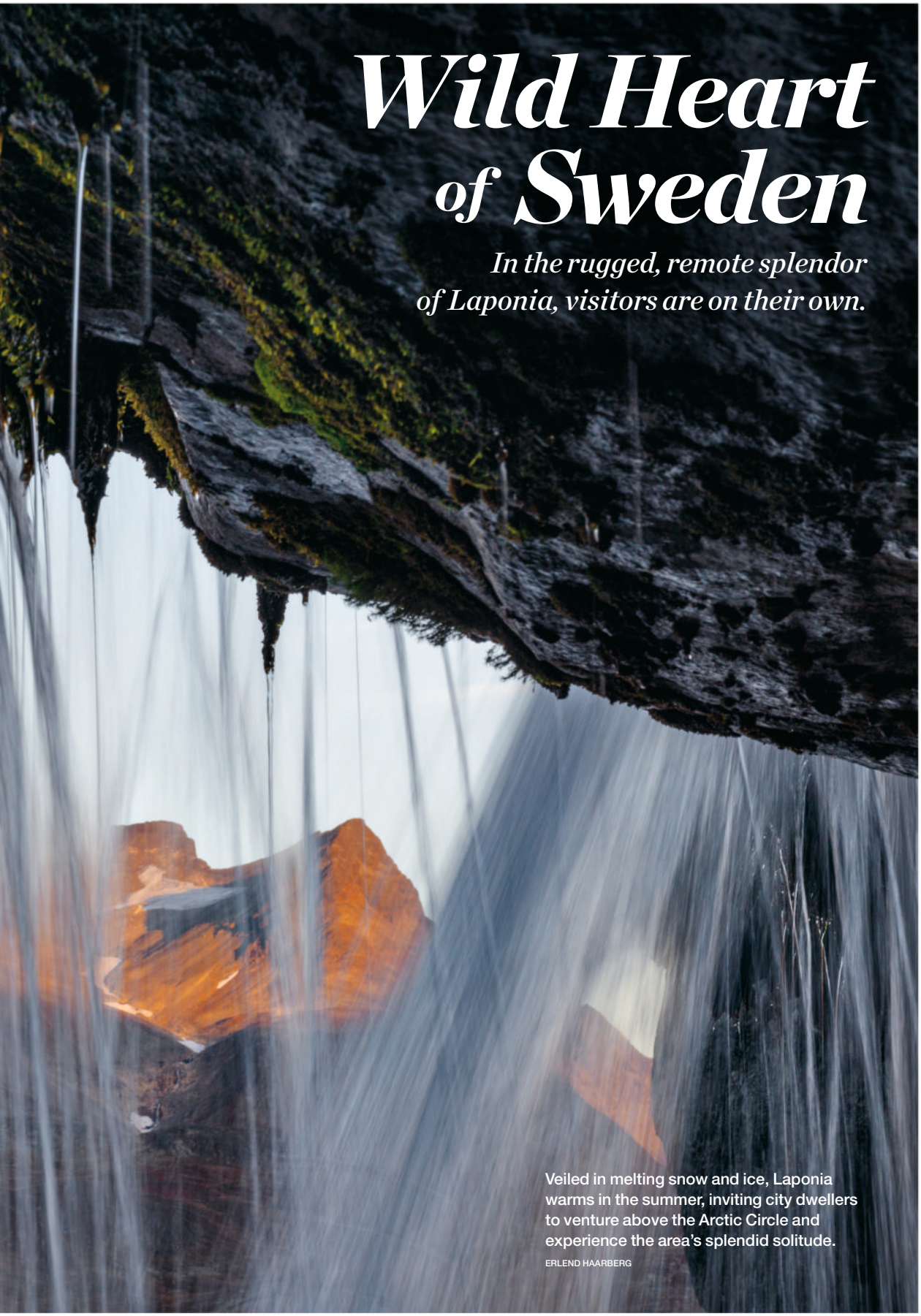


The foot of *H. naledi* is astonishingly humanlike. Only a few traits, such as slightly more curved toe bones, retain a primitive cast. “This is essentially the foot of a modern human, but subtly different,” says paleontologist Will Harcourt-Smith.

ART: STEFAN FICHTEL. SOURCES: LEE BERGER AND PETER SCHMID, WITS; JOHN HAWKS, UNIVERSITY OF WISCONSIN-MADISON

Wild Heart of Sweden

In the rugged, remote splendor of Laponia, visitors are on their own.



Veiled in melting snow and ice, Laponia warms in the summer, inviting city dwellers to venture above the Arctic Circle and experience the area's splendid solitude.

ERLEND HAARBERG



Tangled strands of the Rapa River flow below the slopes of Sarek National Park, one of six reserves that make up Sweden's Laponian Area World Heritage site.

ORSOLYA HAARBERG







Staggered by snow, Norway spruces bend with the weather. “Solitude and spectacle—that’s the essence of Laponia,” says John Utsi, a writer from the town of Jokkmokk.

ERLEND HAARBERG

By Don Belt

Photographs by Orsolya Haarberg and Erlend Haarberg

Not so long ago—just a few days, perhaps—the icy water sluicing around my bare legs was snow on a rocky mountaintop in northern Sweden, a hundred miles above the Arctic Circle. Once that snow melted, it joined the Rapa River, which surges through the heart of Laponia, a 3,630-square-mile primordial landscape of mountains, lakes, and boulder-strewn valleys that is both a sublime natural wonder and one of the largest wilderness areas in Europe. Embracing four Swedish national parks (Padjelanta, Stora Sjöfallet, Muddus, and Sarek) and two nature reserves that together were declared a World Heritage site in 1996, Laponia today provides a vast refuge for wildlife and sanctuary for tech-frazzled human beings—the modern European equivalent of a restorative visit to the Pleistocene.

Laponia is a diverse heritage site with natural and cultural significance, and includes communities of the Sami people (once known as Lapps), who've roamed these northern latitudes for millennia. Yet many people believe that Laponia's still point, its essence, is found right where I'm standing: in the valley of the Rapa River, in Sarek National Park, one of the most remote places on the continent. There are no roads here, no tire tracks, no bridges.

Which is why my two hiking companions (one woman, one man) and I are knee-deep in rushing water with our pants rolled up, and our boots tied together and slung around our necks. Balanced precariously on smooth stones as large and slippery as eggplants, our barefoot trio, Hobbit-like, is fording the Rapa with 50 pounds of weight on our backs.

"Seventy pounds," Christian, our Swedish guide, corrects me. That's how much he's carrying on his back; I'm the one carrying 50. "Actually, your pack is closer to 45," he says.

Tall, blond, and blue-eyed, Christian Heimroth is a laconic outdoorsman, 35 years old, who comes across as a laid-back ski instructor or a retired athlete but is in fact a very astute businessman who owns a wilderness outfitting company based in Jokkmokk.

His summer intern, Karin Karlsson, is also carrying 70 pounds of gear, which is impressive considering she's half his size.

"No way," says Christian. "She's hauling 50, tops. It just looks big because she's a shrimp."

"Watch it, Boss," she fires back. "I may be small, but I bite."

A college student in southern Sweden, Karin has been in Laponia only a few weeks, but she seems to be acclimating. Dark-haired, with horn-rim glasses, she's half Sami and proud of it.

"This place brings out the wild in me," she says, as we pull on boots, hoist our packs, and prepare to move on—a Swedish Iron Man, an aging American reporter, and a Sami Supergirl.

TO REACH THE INTERIOR of Sarek—the heart of Laponia—we've spent days scrambling over boulders crusted with lichens of rusty orange, mint green, and yellow. We've thrashed through birch forests whose leaves were turning yellow, grazed on blueberries and cloudberries, waded through boreal wetlands, sunk in quicksand up to our knees, and found recent tracks of bears and moose—all while searching for a trail that seems to exist only on official maps of the park.

The few trails we have found are paths laid down by wildlife or traditional Sami reindeer herders, who are permitted to graze animals in the park, having been here as long as anyone can remember. At certain *(Continued on page 70)*



Scalloped patterns in gray marble were among the phenomena that awed geologist Axel Hamberg, who conducted a decades-long study of Sarek National Park.

ERLEND HAARBERG



Only the indigenous Sami people may legally hunt moose in Laponia. As a result, the animals grow larger there than in other regions of Sweden. Upstream, the Svenonius Glacier in Sarek National Park (below) provides meltwater for the Njoatsosjåhkå river.

ERLEND HAARBERG (BOTH)





Every season in Laponia brings a gift to the eye, whether a forest-fringed lake mirroring the sky in Muddus National Park (above) or a female rock ptarmigan in winter garb (below). “Birch tops sway against the sky,” wrote Sami poet Nils-Aslak Valkeapää. “Everything remains unsaid.”

ORSOLYA HAARBERG (ABOVE); ERLEND HAARBERG







Footprints of a glacier can be seen from above Muddus National Park, where peaty string fens form in glacier-dug lowlands when the frozen ground melts in spring.

ORSOLYA HAARBERG

(Continued from page 64) times of day in Laponia, especially at dawn, it's easy to imagine what their distant forebears might have seen and heard, after roaming this far north in search of game, wrapped in animal skins, staggered by the roaring winds of glaciers in retreat.

In many ways Sarek is a vision of that newly minted world: massive sharp shoulders of dark rock rising above a landscape carved by ice sheets. The latest one receded from northern Sweden some 9,000 years ago—so recently that the bedrock, relieved of its burden, is still rising up to 0.4 inch a year, in a phenomenon geologists call isostatic rebound.

The melting ice left behind a terrain littered with glacial features: cirques, moraines, drumlins, eskers, lakes, erratics, and boulder-strewn hills. Today, in the perfect hush of wilderness, the incremental grind of glaciers still echoes across Laponia, and it seems only moments ago that the big ice melted, leaving the rhythms of soil and rock, wind and rain, to shape the land.

More recently—perhaps 5,000 years ago—Laponia was settled by nomadic hunters of reindeer who were ancestors of modern-day Sami, the indigenous people of northern Scandinavia whose lives moved to the rhythms of the reindeer herd.

Caucasians who speak a Finno-Ugric language more closely related to Hungarian than to Swedish, the Sami are thought to have rambled north out of central Europe toward the Kola Peninsula of present-day Russia and west across the frozen boreal wastes of what is now Finland, Sweden, and Norway.

Judging from rock art and artifacts recovered in the Laponia region, reindeer defined indigenous culture here from the very beginning, a legacy that can be traced in a continuous line to the Sami of today.

The relationship between the Sami and their fellow Swedes is complex, a product of the centuries-old power imbalance between Sweden's government and its Sami minority, who mostly lived north of the Arctic Circle.

The family of John Utsi, a Sami writer and cultural historian based in Jokkmokk, arrived in Laponia in the 1920s, when his grandfather, Per Mikkelson Utsi, and his family were forcibly removed by the government of Norway from the coastal mountains in Skibotn. They were sent south, to Sweden.

Their arrival caused problems. Even in such a vast region, the newcomers naturally impinged on herders who'd been established there for many generations. And though John, like most modern Sami, doesn't earn his primary living from reindeer herding, the animals—and Laponia itself—play a pivotal role in his life.

"We Sami live a double existence," Utsi says. "We speak Swedish, look Swedish, and most of us live in Swedish towns. But we act Sami, because that's who we are. Chalk it up to genetics."

Whether it's genetics or upbringing, a large number of Sami in northern Sweden spend their summers in Laponia, living in cabins and tending to a few reindeer, fishing, and hunting moose—something other Swedes are not permitted to do in the park.

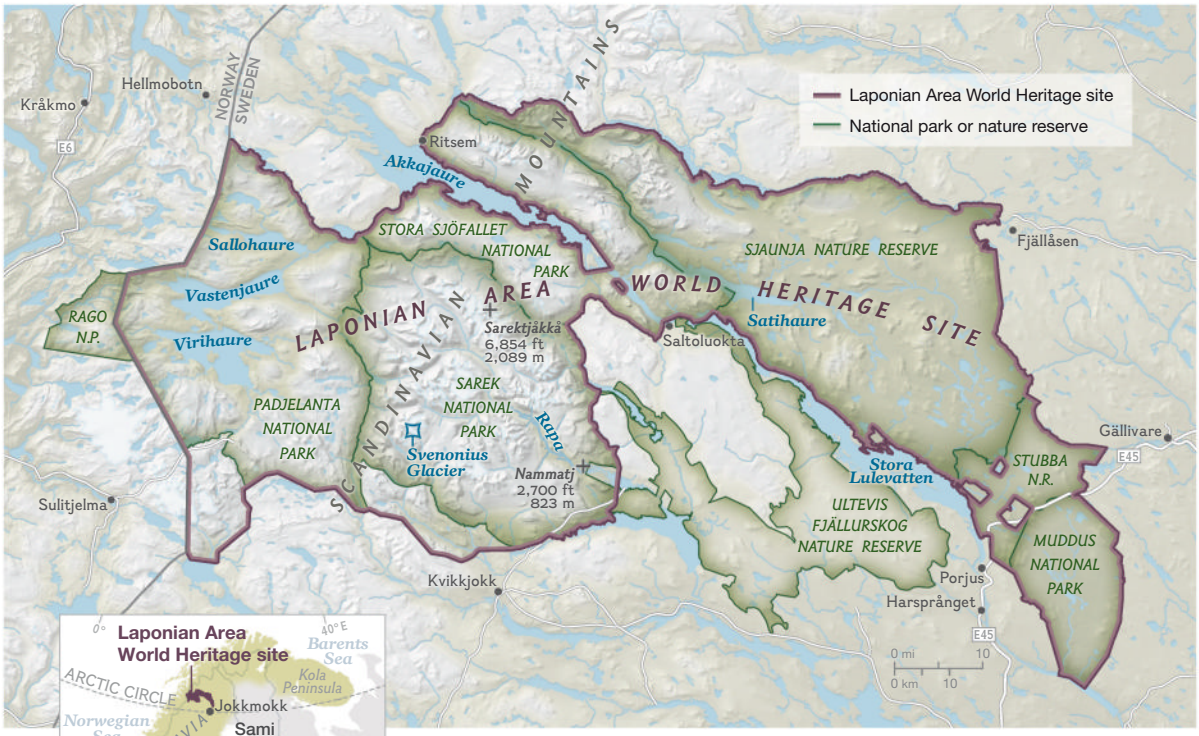
Sami traditions were suppressed by the Swedish government and society for centuries, Utsi says. Those traditions reemerged as the Sami, who experienced a political awakening in the 1970s, demanded and won respect for their culture on the national and international stage.

WHENEVER WE STOP to rest or graze on berries, Christian breaks out a plasticized map of the park. "It's ridiculously easy to get lost in Laponia if you don't pay attention," he says. "Hell, it's



Photographers **Erlend and Orsolya Haarberg** work to capture the Nordic landscape and wildlife. Both have won awards in international photography competitions.

What's it like to work together as a husband-and-wife team?
It's like a dream. We continually support and motivate each other. While working, we enjoy one another's company, and we can be in the field as long as we want, because we aren't leaving our family home alone.



Northern Treasure

Set aside in 1996, the Laponian Area World Heritage site is one of the largest wilderness areas in Europe. Embracing four national parks and two nature reserves, the site is jointly managed by Sweden and its native Sami people, heirs of a nomadic reindeer hunting tradition millennia old.

easy to get lost even if you do pay attention."

As he and Karin study the map, I scan the valley and adjacent slopes and birch stands with binoculars, searching for any movement or dark object in hopes that it might turn out to be a reindeer, brown bear, wolverine, lynx, or moose.

Christian, Karin, and I are the only humans in the park, or think we are, until I catch sight of two distant backpackers disrobing next to an explosively rushing creek, preparing to wade across. Awhile later we greet them as back-country travelers do, warmly and with a certain ritualized generosity, and they seem happy to postpone their mid-morning dip in frigid water.

They are visiting from Germany. One of them, a man of 30 sporting a mane of curly blond hair and a slightly sheepish smile, says they're planning to walk another eight or nine days after crossing the Rapa a few miles upstream.

"Trouble is, we're already running short of food," he says. "Total miscalculation," adds his friend, a tall, goateed fellow with his black hair pulled back in a sleek ponytail, in the style of Zlatan Ibrahimovic, the Swedish soccer star. "We've only been on the trail a few days."

"Are there any emergency phones in there?" he asks, taking in a thousand square miles of trackless wilderness with a careless sweep of his arm. "Just one," Christian says. The travelers blanch, then watch with concern as he notes its distant location on their map, days away from their intended route. "Once in the park, you're pretty much on your own."

We give them a loaf of bread and some granola, and wish them well. Hours later, I spot them from a plateau overlooking the valley. They are miles away—two tiny figures fording the Rapa River in their underwear. Clearly, they're headed off the grid, into the Pleistocene.

There's a small stream a few feet from where I'm standing, a rivulet of pristine meltwater racing down to join the Rapa. I push my cupped hands into the water, raise them, and drink.

Those Germans are going to get mighty hungry wandering around Laponia. But they will never, in their lives, drink better water. ▯

LAUREN C. TIERNEY, NGM STAFF. SOURCES: EUROPEAN ENVIRONMENT AGENCY; LÄNSSTYRELSEN I NORRBOTTENS LÄN; LARS-ANDERS BAER, SAMI PARLIAMENT, SWEDEN; WORLD DATABASE ON PROTECTED AREAS



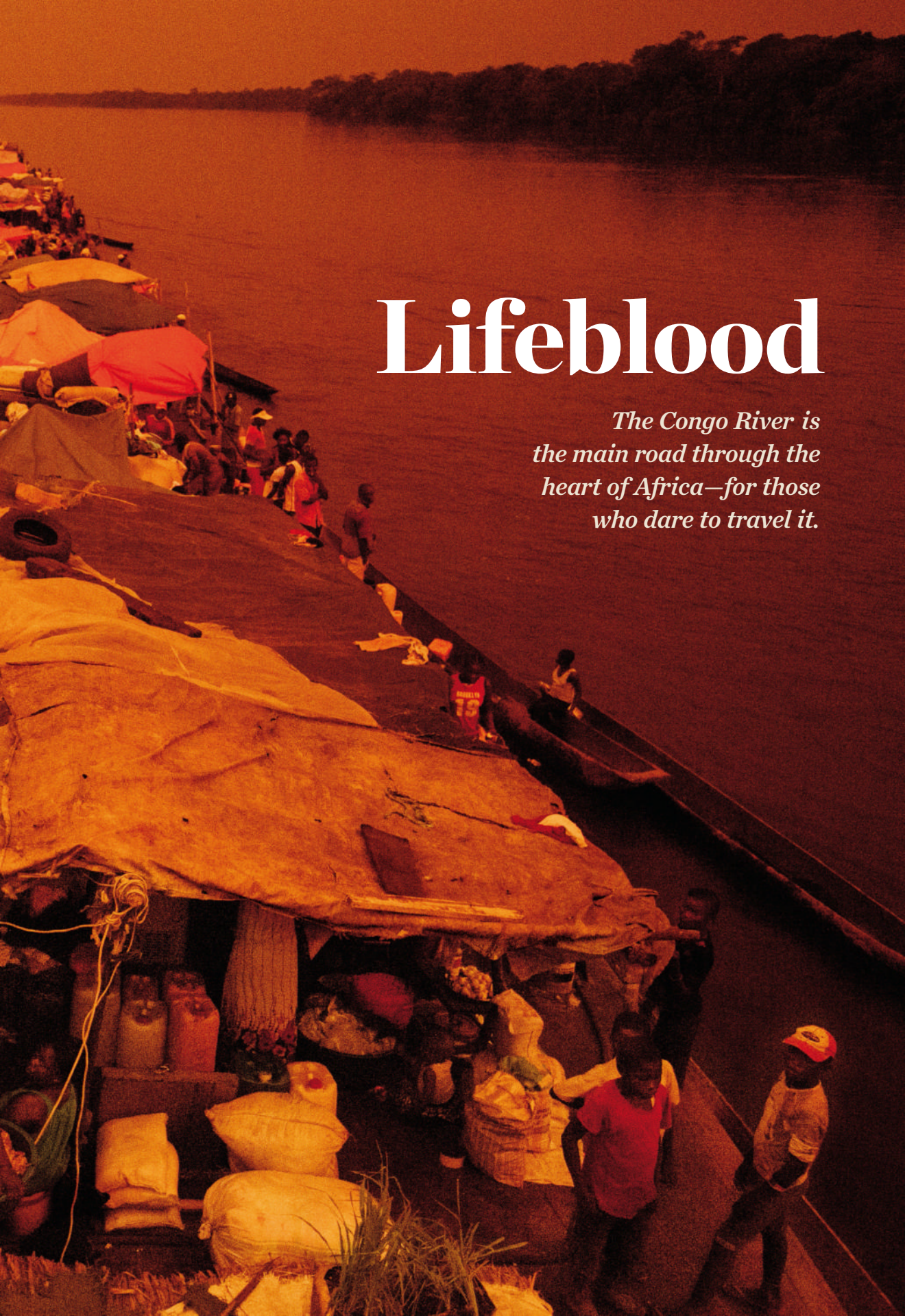


Drama of an autumn storm sweeps into the Rapa Valley, spotlighting Mount Nammatj. Like much of Laponia's landscape, the peak has been sculpted by glaciers.

ORSOLYA HAARBERG



The sun sets on an overcrowded barge as it chugs up the Congo.



Lifeblood

The Congo River is the main road through the heart of Africa—for those who dare to travel it.



With roads scarce in the Democratic Republic of the Congo (DRC), freight barges are often the best option for travel. Passengers cook, sleep, and chat amid teetering piles of cargo.




NAUTICA
19
33



In Maluku passengers disembark from a barge loaded precariously with logs. Timber is big business on the river—and logging it is a source of dangerous erosion.

By Robert Draper
Photographs by Pascal Maitre

The boat travels under a sky seething with starlight. It thrashes its way through a body of water that sometimes seems oceanic in its vastness and at other times barely more than a shallow creek, which is why it is foolish—and for that matter illegal—to be traveling in the dark. To those on the boat, such considerations—what is prudent, what is lawful—are not entirely insignificant. Ultimately, however, a single rule supersedes all others: Here on the Congo River, one does as one must.

The boat is dangerously encumbered. It pushes three barges by means of an engine that was built to convey about 750 tons. The cargo—iron rods, sacks of cement, food products—exceeds 900 tons. Ruffling over the barges is a patchwork roof of tarps and cloth, and beneath it are some 600 human passengers. Perhaps half of them paid up to $80 for the journey upriver. The rest sneaked aboard.

Many are city dwellers hoping to find work harvesting corn and peanuts. A few of the women, toting portable charcoal stoves, have hired themselves out as cooks. Others, as prostitutes. One does as one must. There is singing, bickering, praying. The aromas of charcoal smoke and mortal claustrophobia. Jugs of home-fermented whiskey make the rounds. Now and again an overserved passenger falls overboard. So far no one has drowned, but the journey is still young.

In a berth on the upper level of the boat a slightly built man in his 40s sits in a corner reading a Bible by flashlight. His name is Joseph. Two years ago he acquired this vessel for $800,000. He had been in the air freight business and believed at the time that the rules of the sky would more or less apply to the river.

He has come to learn otherwise. His crew consists primarily of thieves, one of them a nephew by marriage. Joseph estimates that they have smuggled maybe 200 tons of excess cargo onto the boat—taxing the engine, slowing the pace, risking running the boat aground and thus imperiling everyone on board, and of course cheating the owner out of the profits.

Joseph worries that the crew knows he's on to them. He fears they will pay the cook to poison his food. Bread and butter are all he'll take for nourishment. He is disgusted by all the depravity. The other night the captain cut the engine for a few hours so that he could climb down to a barge and have his way with some of the female passengers. And so Joseph takes refuge in his Bible. He is surrounded by sinners. He is one himself. Others in his family are preachers, but Joseph loves money. At the end of the year, after all is said and done, he will be $100,000 wealthier. By then, perhaps it will be worth it.

"Do you have more aspirin?" he asks me.



Public boats, with ample sleeping quarters, plied the Congo until the government of the DRC let them fall into disrepair. Now river traffic consists largely of barges (top) and pirogues (center).

I hand him a couple of pills, which he gratefully takes with his Coca-Cola. Photographer Pascal Maitre and I are sympathetic to Joseph. We joined his boat after a ten-day debacle involving another boat in the port of Kinshasa. That boat was called—promisingly, we thought at the time—the *Kwema Express*. The boat's manager was a stocky and unflappable fellow who charged us for a berth, for an accompanying pirogue with outboard motor, for security, for maintenance, for new parts, for all sorts of official papers, for everything he could think of, perhaps $5,000 worth, pretty much cleaning us out. All well and good. But then the boat's engine wouldn't start. Then the boat couldn't be dislodged from the silt. Then a swollen human body was discovered bobbing alongside.

We decided to cut our losses. We heard about Joseph and his boat, met with him in a Kinshasa hotel, came to terms, wired for more money, and then flew with him to the mangy port city of Mbandaka, where his crew was busily overloading the boat with black market cargo by day and making merry with the local women by night. Two days later we are at last on our way, plowing upstream to Kisangani, the city at the fabled bend in the river.

Our aim is to understand this one constant in the turbulent history of the Democratic Republic of the Congo (DRC). Does the mighty river offer some untapped promise for a nation long stricken with poverty and corruption? Or is the Congo River a universe of its own?

It's February, the dry season, and the river is low and malty. Falcons soar, and waterfowl skitter across the sky. Every few miles the immensity of rain forest hemming the water gives way to a rickety collection of thatched-roof homes. Children pour out of them, waving. Some climb into their pirogues and paddle ferociously toward the boat so as to ride its wake like spindly little surfers. The last of the pirogues disappears back into the bush under a raging sunset. At night Pascal and I lie in sleeping bags under mosquito nets on the roof of the boat, directly above us a tattered DRC flag. There is no electricity to corrupt the heavens. No noise of any kind except for the growling of the engine until early in the

morning, when we wake to the sound of song. A preacher is leading other passengers in prayer. We climb down to investigate.

Dawn hasn't yet broken, but already coal fires are burning and women are frying beignets. Other passengers have risen from their foam mattresses and begun to lay out their wares for sale: soap, batteries, herbal potions, shoes, rancid whiskey. Soon visitors from deep in the bush will paddle up in their pirogues and hoist themselves spiderlike aboard the barges, bearing their own products to barter: bananas, catfish, carp, boas, baboons, ducks, crocodiles. The floating marketplace will proceed throughout the day, with as many as a dozen pirogues lashed to the boat at any given time. It soon becomes clear to us that the regimen is completely symbiotic and anything but frivolous. Absent this commerce, the passengers don't eat and the villagers don't have medication for a baby's fever or a new pot to replace the rusted one.

The preacher, whose name is Simon, is selling used jeans and shirts. He's traveling to a church in Lisala, the birthplace of the former dictator Mobutu Sese Seko. "Back in Mobutu's time I could afford to have a good room of my own," he laments, referring to the barge—but also perhaps to the disorder under the DRC's current president, Joseph Kabila. "It's hard to enjoy these conditions. All we can do is pray to put this trip in God's hands."

Simon has a companion, a broad-shouldered man named Celestin who owns a small rubber and palm oil plantation in Binga, a village alongside a tributary known as the Mongala River. He seems entranced to see two white foreigners aboard the boat.

"I had a dream last night that two strangers came to visit my plantation," Celestin tells us. "So perhaps God has sent you!"

We smile back and mumble our appreciation for the invitation. We also make no promises. The first thing you learn when you're on the Congo River is that nothing is governable, least of all the pace. The river is low, the boat is heavy, the captain is guzzling Congolese whiskey from a jar, the owner has retreated into Scripture. Though out here we are the lucky ones, out here luck is the flimsiest currency of all.

THE RIVER CONNECTS nine African countries along its nearly 3,000-mile journey to the Atlantic Ocean, but its identity is inseparable from that of the Democratic Republic of the Congo.

"The Congo River is the spine of our country," says Isidore Ndaywel è Nziem, a professor of history at the University of Kinshasa. "Without a spine, a man cannot stand up." Seen this way, the river pathway—which, after traveling northward from Boyoma Falls (formerly Stanley Falls, for the great explorer Henry Morton Stanley), takes a southwestward plunge toward the ocean—traces the figure of a dogged but severely hobbled peasant. That it has no real governing authority makes the Congo River the nation's great equalizer. It also greatly diminishes the river's value as a resource. Given the 1.5 million-square-mile river basin's immense hydroelectric and agricultural potential, all of Africa could be beholden to it, and thus to its mother country. Instead the river remains wild, and the DRC staggers under the weight of overpopulation, poverty, lawlessness, and corruption.

The river and its tributaries have served as human-migration pathways traceable back to Bantu-speaking settlers in 400 B.C. For the DRC today, the waterways function as the primary connective tissue between the village, the city, the ocean, and the outside world. Such facts do not capture its full significance, however. That the Congo River has long been viewed as far more than its mighty discharge—an average of nearly 1.5 million cubic feet per second—and that it might hold the key to diamonds, minerals, or anything else coveted by civilizations is a matter of historical record. In 1885 Belgium's King Leopold II colonized the Congo Free State, a country nearly 80 times the size of his own, damning all cost and regard for human rights in his frenzied quest to exploit the river basin's rubber trade. Joseph Conrad's 1902 classic novel *Heart of Darkness* chronicled the folly of Western ivory traders pillaging a shadowy, indomitable river basin. More than a century

later the Congo's place in our imagination hasn't changed. Nor has the ongoing failure to tame it.

For decades the government-owned Office National des Transports, or ONATRA, held a monopoly on all river traffic and commerce. That changed during the 1990s, in the waning years of the Mobutu regime. As top ONATRA official Sylvestre Many Tra Hamany acknowledges, "Our boat engines became old and started breaking down, which caused long delays and the loss of our credibility."

In response, says Thierry André Mayele of the waterways management authority Régie des Voies Fluviales (RVF), "Our politicians decided to liberalize navigation of the river chiefly so that they themselves could profit in the business." The Congolese officials wrote regulatory and taxing laws that could be circumvented effortlessly. They paid port commissars so meagerly that bribery and extortion would trump all else. They starved ONATRA, RVF, and every other river authority of resources. So it holds today. The government has seen to it that the DRC's greatest natural treasure is thoroughly ungoverned.

Those who travel the river know this, know the attendant risks. The ongoing exploitation of the river basin's timber by local and foreign interests has contributed to substantial erosion. This reality—combined with the government's failure to dredge the river, the ease with which boat crews can bribe port authorities to ignore excess tonnage, and the absence of emergency vessels on the water—means that passengers enter a fateful lottery when they embark. "Every year on average five boats sink due to being overloaded with cargo," says Mayele. Two months before we boarded Joseph's boat, a similar vessel capsized not far from Kinshasa. According to Mayele, "The captain was drunk and hit a rock. On a big boat like that one, there's no way of knowing how many passengers drowned, because there's no manifest."

He adds, "The figures put out by the government say 30 or 40 died." His skeptical chuckle tells the rest.

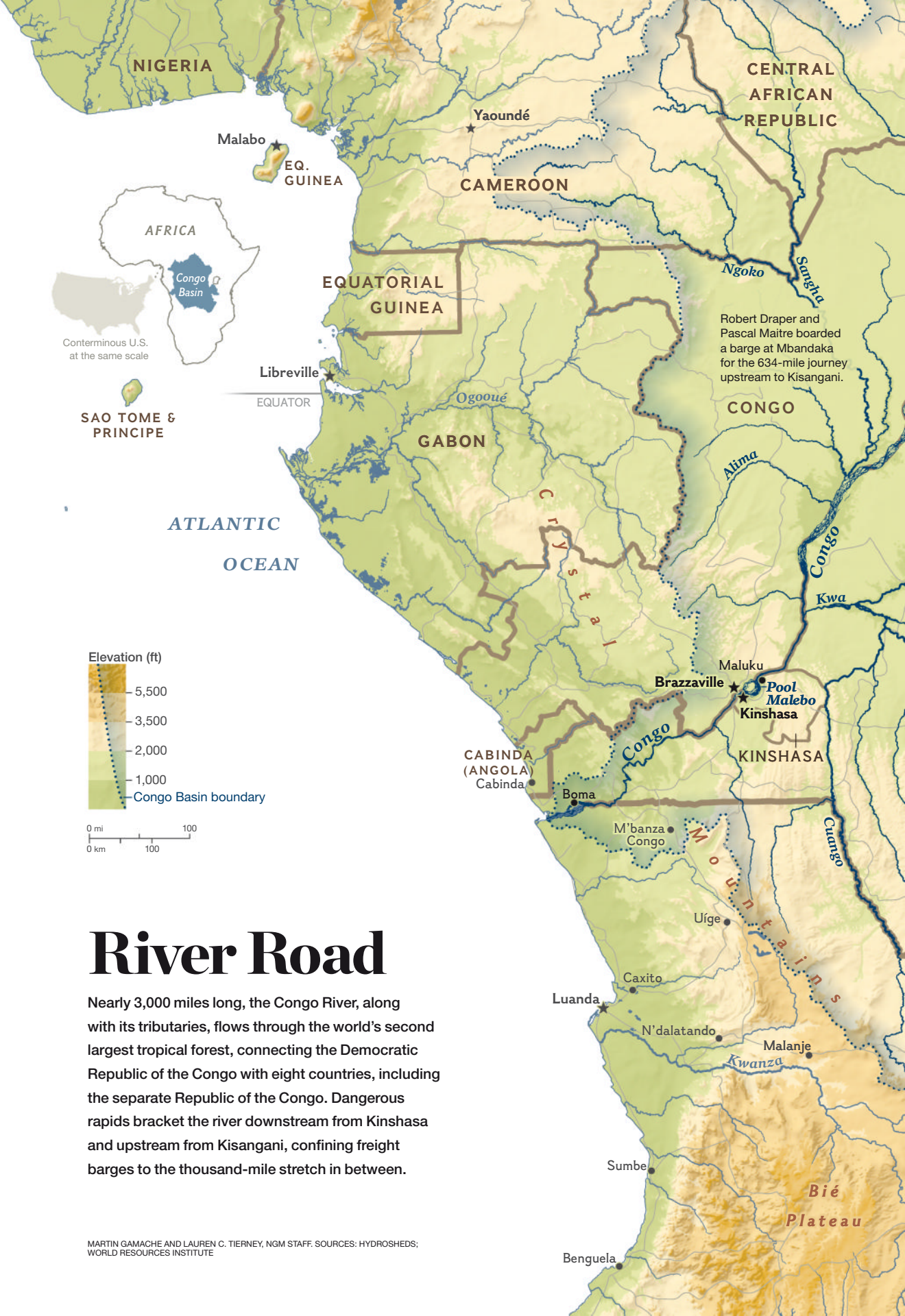
STILL, THE PRECARIOUSNESS of the river traffic only hints at the wholesale abandonment of the Congo by the DRC. To discover the most searing evidence of that abandonment, one must travel deeper into the river basin, as Pascal and I do months later, on a vessel much smaller than a floating village. One must willingly become unfixed from chronology and crisp itineraries, move gamely with the current until information gleaned from passing conversations with other river dwellers prompts a detour. Scan the shoreline for signs of life in the bush. Disembark. And have faith.

The river is low, the boat is heavy, the captain is guzzling Congolese whiskey from a jar.

We find the village of Yailombo, a community of 200 fishing families, after renting a pirogue with an outboard motor in Kisangani, heading three hours downriver to Isangi, then turning south on the Lomami River, a major tributary of the Congo that we follow for a full day. It's now November, and by late morning the sunlight is so scorching that the women we see transporting plantains and cassava on pirogues hold umbrellas overhead to protect the infants they're cradling.

Upon disembarking, I follow the sounds of chanting schoolchildren. They're sitting on plastic chairs, crammed into what looks like a large, dilapidated bamboo cage. The teacher is Cesar, 23, with a wispy mustache and a shy smile. I can tell by his ropy arms that he also works on the river.

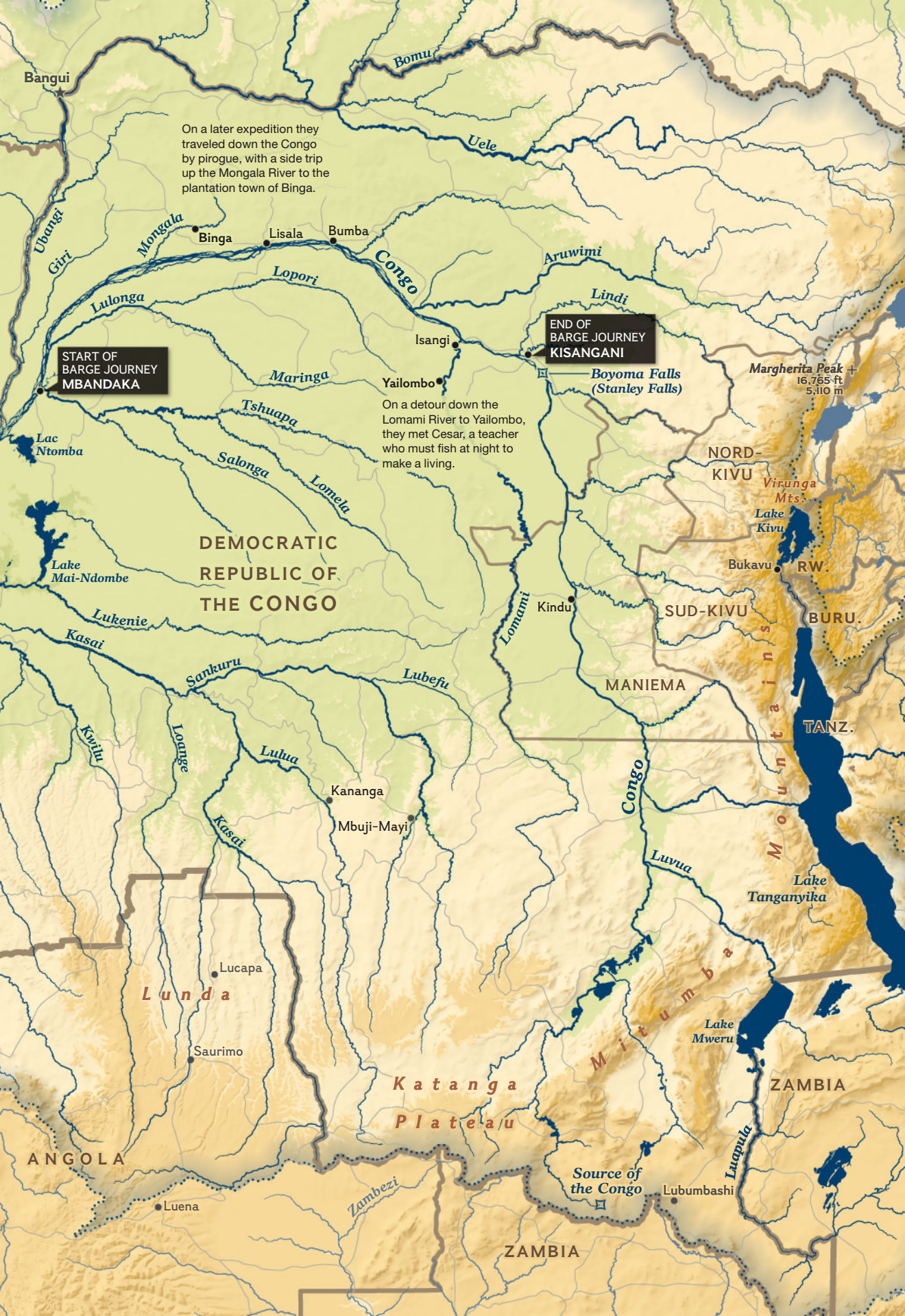
"Well," he explains, "I fish from six at night until six in the morning. *(Continued on page 92)*



River Road

Nearly 3,000 miles long, the Congo River, along with its tributaries, flows through the world's second largest tropical forest, connecting the Democratic Republic of the Congo with eight countries, including the separate Republic of the Congo. Dangerous rapids bracket the river downstream from Kinshasa and upstream from Kisangani, confining freight barges to the thousand-mile stretch in between.

MARTIN GAMACHE AND LAUREN C. TIERNEY, NGM STAFF. SOURCES: HYDROSHEDS; WORLD RESOURCES INSTITUTE


Bangui
Bomu
Uele
On a later expedition they traveled down the Congo by pirogue, with a side trip up the Mongala River to the plantation town of Binga.
Ubangi
Giri
Mongala
Binga
Lisala
Bumba
Congo
Aruwimi
Lopori
Lindi
Lulonga
END OF BARGE JOURNEY
KISANGANI
Isangi
Boyoma Falls (Stanley Falls)
Margherita Peak
16,765 ft
5,110 m
START OF BARGE JOURNEY
MBANDAKA
Maringa
Yailombo
On a detour down the Lomami River to Yailombo, they met Cesar, a teacher who must fish at night to make a living.
Tshuapa
Lac Ntomba
Salonga
Lomela
NORD-KIVU
Virunga Mts.
Lake Kivu
DEMOCRATIC REPUBLIC OF THE CONGO
Lake Mai-Ndombe
Bukavu
RW.
Kindu
Lomami
SUD-KIVU
BURU.
Lukenie
Kasai
Sankuru
Lubefu
MANIEMA
Mountains
TANZ.
Kwilu
Loange
Lulua
Kananga
Mbuji-Mayi
Kasai
Congo
Luvua
Lake Tanganyika
Lucapa
Lunda
Mitumba
Lake Mweru
Saurimo
Katanga Plateau
ZAMBIA
ANGOLA
Luapula
Source of the Congo
Lubumbashi
Zambezi
Luena
ZAMBIA





Floating Village

Travel on the Congo requires patience. Progress can be as slow as a few miles an hour. Barges get stuck in silt. Engines break down. Time inches by. Men play checkers (top left). Women cook, clean, mind the children—and wait. When a barge passes a village, pirogues shoot out from the riverbanks, piloted by local people with goods to sell. The barge transforms into a lively marketplace while still churning slowly toward its destination. Passengers offer up household supplies like clothes, medicine, and rice. Villagers bring the bounty of the jungle, including monkeys, snakes, and pigs (bottom left). The pigs, purchased to sell at a profit later in the journey, travel as humans do: cheek by jowl in the midst of the cargo.







Despite the crowded conditions, a young woman has managed to stake out a place to lay her head during the long voyage upriver to her home in Kisangani.

Then I teach from seven until noon. Teaching doesn't pay me enough to feed my family." What he catches, he smoke cures, and his wife then transports the dried fish by water to Kisangani—five or six days of paddling each way. Kisangani, Cesar says, is the farthest from home that he's ever been.

For teaching Yailombo's 53 third graders, he says, the villagers pay him about $18.50 a month. The bamboo schoolhouse is all the village has, because it takes more than a day by pirogue to get to the nearest government-registered school.

"Has anyone from the Congolese government ever visited Yailombo?" I ask.

Cesar nods. "During election season, when they campaign with their propaganda," he says. "They come and make promises to build a clinic or a school. It never happens."

Like every other village we visit, Yailombo has no clinic, no paved roads, no cars, no running water, no electricity, no phone service, no Internet, no police, no newspapers. What it has are the river and the bush. If nothing else, the remoteness protects such hamlets from the carnage inflicted by militias in the eastern DRC. Several days before arriving in Yailombo, on the outskirts of Kisangani, we encountered Wagenia fishermen, who are famed for their audacious method of netting fish while clinging to bamboo scaffolds just above the Congo River's frothing cataracts. When I asked the 47-year-old Wagenia chief, Beaka Aifila, if there'd ever been a time when his people had felt the presence of an external authority, he didn't hesitate.

"During the six-day war," he replied, referring to the June 2000 conflict between Ugandan and Rwandan troops in the brutal Second Congo War (1998-2003), when heavy fighting spilled over into Kisangani. "In the mornings when we checked our nets, we found human bodies instead of fish."

WE LEAVE THE LOMAMI RIVER and return to the Congo. It's now the rainy season, and we have the great river practically to ourselves as we head northwest with the current. Days pass without the sight of another motorized vessel. For whatever reason, commerce is slow, barges are scarce. At the same time, the fishermen in their pirogues are having less luck in the rain-swollen river. We buy everything they have. Whenever we hear of markets, we go to them—bustling bazaars a mile or so into the bush—and acquire peanuts, bananas, bread, tomatoes, charcoal.

Each stop at one of the larger river towns—which we make only when we must, for gasoline and other important supplies—entails a dreary encounter with some uniformed official from the Direction Générale de Migration, who pores over our papers and asks the same skeptical questions and ultimately demands his price for the favor of leaving us alone. Our traveling group includes an affable fellow from the Kisangani office of the Agence Nationale de Renseignements (ANR), the Congo's version of the FBI. Ostensibly we're paying him to ensure our expeditious passage downriver. In practice, he's there to help drink our beer.

From time to time the brilliant azure skies darken, an avalanche of rain pummels our pirogue, and we duck into a cove of raggedy homes on stilts, where the fishermen take us in and offer us yellow plastic jugs full of palm wine. At dusk we seek out bare tracts along the river where we can spread our sleeping bags and cook our food. The locals gather around us and stare at our laptops for as long as we use them. We push out early each morning after first paying the fishermen for the use of their land. The distant sight of them still waving from the shoreline of those unnamed communes is what I choose to remember rather than the uniformed grifters in Bumba and Lisala.

After a long day plowing up the storm-churned Mongala River, a tributary to the Congo, we arrive late one evening at the port town of Binga. A large bald man climbs out of a pickup truck and embraces us at the docks. It's Celestin, the passenger on Joseph's boat who'd dreamed that two foreigners would come visit him.

For the next few nights in Binga, Pascal and I are treated to surprising comfort, reposing in a handsome four-bedroom house of wood

and concrete with vaulted ceilings. The house is owned by the American CEO of the plantation company that dominates Binga. How Celestin secured it for our stay is never made clear. The original occupant was a Belgian who established the rubber company in 1914 in what had hitherto been a nondescript fishing village named Mbinkya, later bastardized by the colonizers to Binga. There had been beautiful paintings on the walls. A Ping-Pong table. A Mercedes in the driveway. Electrical power around the clock, here and throughout the town. Then in 1997 Mobutu fell; two years later the Belgians fled Binga. Rebels looted the rubber baron's home. Today the American CEO visits infrequently.

The plantations now grow mainly palm trees for oil. The number of full-time salaried workers has been reduced from 4,000 to 650. The town no longer has electricity. A total of three cars—all owned by the company—share Binga's muddy thoroughfares with pedestrians and motorcyclists. Nostalgia for that comparatively gilded era pervades the town.

The company remains here for a reason—three of them really. The tropical climate is optimal for rubber and palm trees, the labor is cheap, and the river makes possible the barging of its products 800 miles downstream to a waiting Western market. In turn Binga retains the ethos of a company town—albeit with threadbare benefits. For its 67,000 inhabitants, the 2,000 seasonal jobs on the plantations are the only alternative to the subsistence life of fishing, hunting, and farming. The company maintains schools and clinics.

Yet a traditional Ngombe structure persists. A resident told me that recently the chief had grown angry at the failure of the local fishermen to respect Ngombe ways and punished them by putting a curse on the town's fishing trade. For three years, I was told, few fish were caught, and many people starved. The fishermen were brought to their knees, and the chief removed the curse. All of this suggested to me a show of muscle for which the warlike Ngombe were once known, before the minions of King Leopold came to exploit the river basin.

"The Belgian colonization killed the Congolese soul," historian Kambayi Bwatshia later told me. "In these plantations they were sending people to work by force and cutting their hands off if they didn't work hard enough. Those who are saying it was better under colonization—or under Mobutu—are simply tired of the chaos. Still, underneath it all, they want to recover their dignity."

If nothing else, the remoteness protects the hamlets from the carnage in the eastern DRC.

Those last words apply all too poignantly to Celestin. One morning I hop on the back of his motorcycle, and we drive for a half hour along rain-spattered dirt roads until we arrive at his family's plantation—expansive but scruffy, hardly resembling the geometric order of the American plantation. Still, it's with evident pride that Celestin tells me, "This concession was bought by my father in 1980. It travels 800 meters [875 yards] along the road and extends four miles into the forest. It was all bush when he bought it. He had a good job with the Belgian company and saved up his money. I was the third of ten children. We grew up with air-conditioning, with a jeep, with sausage and cheese—with all these beautiful things. It was a privilege to grow up under such conditions, when for all the other Congolese living along the river, life is so difficult. We imitated the life of Westerners. You see a white man starting a plantation, and you think, Even if I can't be just like him, at least I can start a small plantation of my own and feed my family on my own."

Celestin points off *(Continued on page 100)*





Ebb and Flow

Colonialists flee, despots fall—and people on the banks of the Congo make use of what's been left behind. In Lisala, birthplace of the late dictator Mobutu Sese Seko, children attend school in the faded rooms of one of his former residences (top left). Elsewhere along the river, villagers operate a mill (below) to process palm oil harvested from trees growing wild in an abandoned plantation nearby. Some ways of life go on as they always have. Wagenia fishermen still craft enormous traps to snare fish in the roiling rapids outside of Kisangani (bottom left), just as they did when the explorer Henry Morton Stanley first observed them during his famous voyage down the river in 1877.







New pirogues attract buyers at the biggest market on the Congo for these dugout canoes, near Bumba. Builders trek deep into the jungle for suitable trees; sales allow them to live slightly above subsistence level.





Children learn to paddle pirogues at a young age. This boy's family built a small temporary home on the banks of the Mongala River, a tributary of the Congo, to catch fish in the river and in a nearby lake.



Engine trouble and other mishaps delayed the *Kwema Express* during its voyage up the Congo. After eight months the barge finally reached Kisangani.

into the forest. It was there, he says, that he and his family hid for a month in 1999, living off bananas and cassavas and occasionally bush meat, while the Congolese rebels ransacked the family home. "Life isn't comparable to the period before the war," he says. But, he adds, "I must continue with the plantation. It's important for my children. Plantations are stable. You can eat and send your kids to a decent school and be present to help educate them. It's not much, but you're stable." He says that he sells his palm oil to the American plantation company for a decidedly monopolistic price. In the past few years both his profits and his dignity have taken a hit. He would like to recover both.

Lately he's considered expanding his rubber holdings and getting into cacao, which would require $10,000 in seed money. Or starting a dairy farm, necessitating $1,500 for five cows. Perhaps, he suggests, I could be his partner. Or I could find someone from the West—not a sponsor, an investor—though his expression is downcast as he admits that Binga's best days, such as they were, are in the past and that the future for his 12-year-old son, Celestin Jr., must lie elsewhere.

"I want my boy to stay here in Binga, to develop



himself," Celestin says. "Then he can go find the good life. Maybe in Europe or America. Not here, unfortunately."

DURING MY LAST DAY on the Congo River the weather is placid, and we are proceeding briskly downstream, when another motorized pirogue roars up from the far shoreline. In it are four young men in camouflage uniforms, bearing AK-47s. They are hollering in Lingala. One of them ropes our boats together. Two of them step aboard, holding their rifles at their hips. Their eyes widen when they see two Westerners. The scenario is a familiar one; it usually doesn't end well.

The young men claim to be policemen of some sort. They say that we deliberately skirted their village without stopping to "register." We are unauthorized, they maintain. Our fixers and the pirogue captain are all prideful young men who yell back at them. Pascal and I beg for calm. Our ANR passenger remains, as always, exquisitely useless.

We are a mere 30 miles from our destination, Mbandaka, where I plan to catch a flight to Kinshasha. The 345,000 inhabitants of that port city might as well be on another continent. The river at this juncture is a mile wide. Its sovereignty is its wildness. One does as one must. The pirogue that these men have intercepted carries two laptops, four cameras, thousands of dollars in cash, and eight human lives. We are not going to win this. The only question is how much we will lose.

After 30 minutes, a few cigarettes, a couple of bottles of water, and a dialogue that settles into a kind of fatigued stalemate before taking a weirdly jovial turn—Hey, you like Congo? I like America!—the young men finally name their price. Their outboard motor is out of gas. And so they would like a full tank. And ten dollars.

A fair price. We shake hands—it was only river commerce, after all—and then wave goodbye as the grinning young men with their guns swerve away from us, eventually disappearing into the silver-dark current somewhere beyond. □



REBECCA HALE, NGM STAFF

A contributing writer for *National Geographic,* **Robert Draper** has written more than a dozen stories for the magazine, traveling to locales as varied as Madagascar's rain forests and Greece's monasteries.

What amazed you about life on the Congo River? I was most surprised by the nearly complete absence of infrastructure in the river villages we visited. Life there may seem sweet and simple to the passerby, but in truth, it's one of deprivation, with virtually no economic opportunity.



In the La Mosquitia region of Honduras, former British Special Air Service officer Andrew Wood machetes a trail to ruins of a pre-Columbian city, first detected from the air by a technology called lidar.



El Dorado. Atlantis. The Lost City of Z. Legends of such fabled places have enticed generations of explorers into the most remote locations on Earth. Usually they return empty-handed, if they return at all. But sometimes the pursuit of a myth leads to a real discovery.

Lure of the Lost City



In the ruins archaeologists discovered a cache of stone objects, possibly left as an offering. They include jars decorated with the images of vultures and snakes.

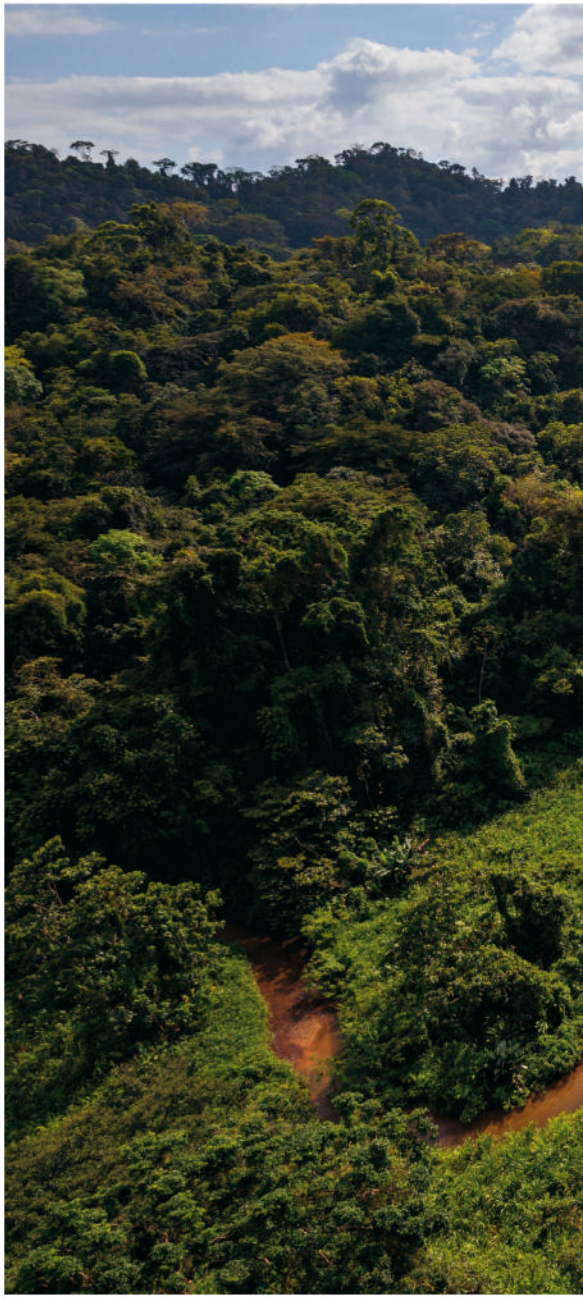


By Douglas Preston
Photographs by Dave Yoder

On February 18, 2015, a military helicopter lifted off from a shabby airstrip near the town of Catacamas, Honduras, and headed toward the mountains of La Mosquitia on the northeast horizon. Below, farms gradually gave way to steep sunlit slopes, some covered with unbroken rain forest, others partially stripped for cattle ranching. Picking his way through the summits, the pilot headed for a V-shaped notch in a distant ridge. Beyond it lay a valley surrounded by serrated peaks: an unblemished landscape of emerald and gold, dappled with the drifting shadows of clouds. Flocks of egrets flew below, and the treetops thrashed with the movement of unseen monkeys. There were no signs of human life—not a road, a trail, or a wisp of smoke. The pilot banked and descended, aiming for a clearing along a riverbank.

Among those stepping from the helicopter was an archaeologist named Chris Fisher. The valley was in a region long rumored to harbor "Ciudad Blanca"—a mythic metropolis built of white stone, also known as the Lost City of the Monkey God. Fisher did not believe in such legends. But he did believe that the valley, known to him and his companions simply as T1, contained the ruins of a real lost city, abandoned for at least half a millennium. In fact, he was certain of it.

All they had to do was go and look for it.



EXPLORER

Tune in Sunday, October 4 to National Geographic Channel's *Explorer* series for more on the ongoing quest in Mosquitia.



Covering 20,000 square miles in Honduras and Nicaragua, Mosquitia contains the largest rain forest in Central America and some of the last areas on Earth that scientists have yet to explore. “The importance of this place can’t be overestimated,” says ethnobotanist Mark Plotkin.

Archaeology from above

Technology called lidar is revolutionizing archaeology. By measuring the distance light travels to the ground and back, researchers can digitally strip away the canopy from forested areas like Mosquitia, in Honduras—revealing ancient settlements.

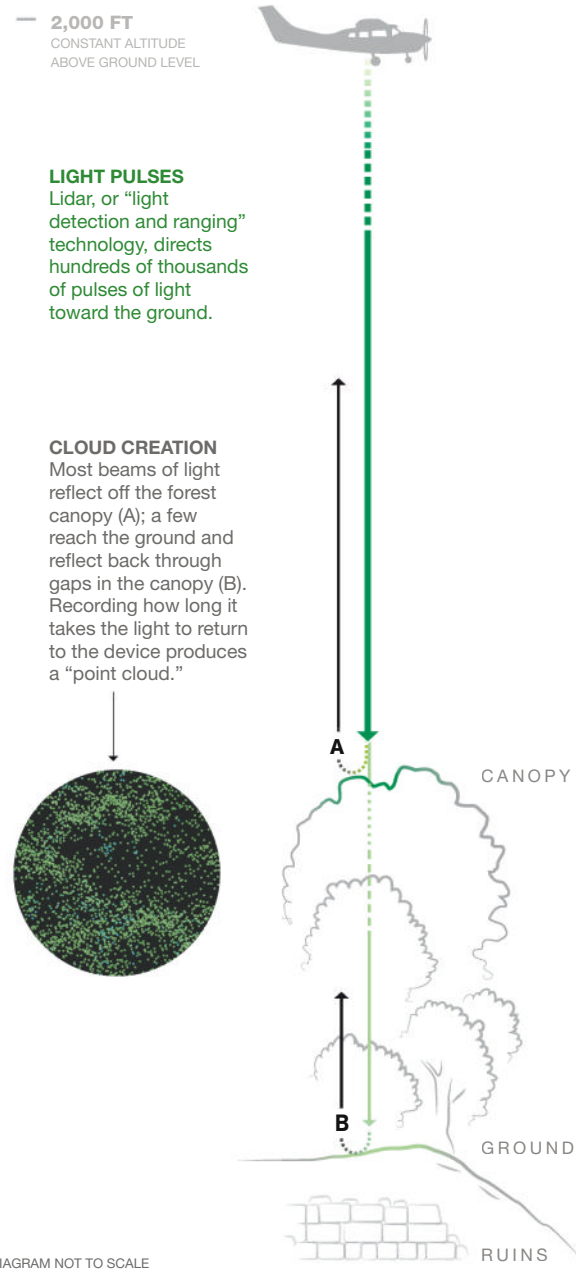
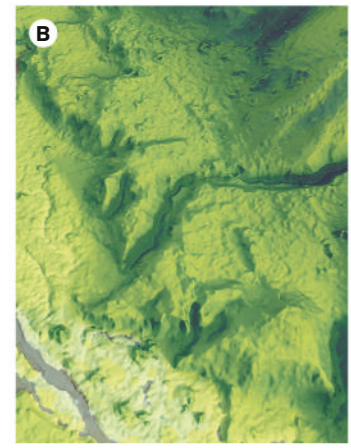


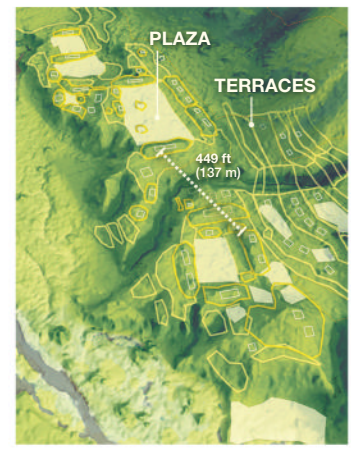
DIAGRAM NOT TO SCALE



Canopy Researchers use sophisticated software to translate the reflected laser points in the point cloud to create a model of the forest canopy.



Ground By identifying the laser points that reach and reflect off the ground, researchers produce bare-earth topographic models.



Signs of Life? Experts then look for traces of man-made structures or human-induced changes to the landscape to identify promising sites for excavation.

MANUEL CANALES, NGM STAFF; AMANDA HOBBS. ART: GREG HARLIN. DIGITAL RENDERING: STEFAN FICHTEL
SOURCES: JUAN CARLOS FERNÁNDEZ-DIAZ, NCALM/UNIVERSITY OF HOUSTON;
CHRISTOPHER T. FISHER, COLORADO STATE UNIVERSITY; ALICIA M. GONZÁLEZ; UTL PRODUCTIONS


BUILDINGS
Large thatched-roof structures likely had stone foundations; smaller ones were made of wood and earth.
LOST CITY ILLUMINATED
An artist used lidar data to portray structures surveyed in the T1 valley in Mosquitia during the February 2015 expedition. Many more features remain to be mapped and explored.
TERRACES
Farmers cut terraces into the land, making it easier to grow and harvest crops.
PLAZA
Open areas flanked by mounds were probably used for large gatherings.
MOUNDS
Earthen mounds of different shapes and sizes are scattered throughout the site. They likely supported structures.
EARTHEN PYRAMID
CANALS
Evidence hints that canals were dug to irrigate agricultural areas.
CACHE
Fifty-two artifacts, including a stone seat decorated with the head of a jaguar, were found poking out of the ground at the base of an earthen pyramid.

THE MOSQUITIA REGION of Honduras and Nicaragua holds the largest rain forest in Central America, covering some 20,000 square miles of dense vegetation, swamps, and rivers. From above it may look inviting, but anyone venturing into it faces a host of dangers: deadly snakes, hungry jaguars, and noxious insects, some carrying potentially lethal diseases. The persistence of the myth of a hidden White City owes a great deal to the forbidding nature of this wilderness. But the origin of the legend is obscure. Explorers, prospectors, and early aviators spoke of glimpsing the white ramparts of a ruined city rising above the jungle; others repeated tales, first recorded by Hernán Cortés in 1526, of fabulously rich towns hidden in the Honduran interior. Anthropologists who spent time with the Miskito, Pech, and Tawahka Indians of Mosquitia heard stories of a "White House," a refuge where indigenous people retreated from the Spanish conquest, never to be seen again.

Mosquitia lies on the frontier of Mesoamerica, adjacent to the realm of the Maya. While the Maya are among the most studied of ancient cultures in the Americas, the people of Mosquitia are among the most mysterious—a question mark embodied by the legend of the White City. Over time the myth became a part of the Honduran national consciousness. By the 1930s Ciudad Blanca had also captured the imagination of the American public, and in many quarters it was taken seriously. Several expeditions were launched to find it, including three by the Museum of the American Indian in New York City financed by George Gustav Heye, an avid collector of Native American artifacts. The first two came back with rumors of a lost city containing a giant statue of a monkey god, waiting to be unearthed.

The museum's third expedition, led by an eccentric journalist named Theodore Morde, landed in Honduras in 1940. Morde emerged from the jungle five months later with crates of artifacts. "The City of the Monkey God was walled," Morde wrote. "We traced one wall until it vanished under mounds that have all the evidence of once being great buildings." Morde declined to reveal the location, for fear, he said, of looting, but he promised to return the following year to begin excavations. He never did, and in 1954 he hanged himself in a shower stall. His city, if there was one, remains unidentified.

In subsequent decades archaeology in Mosquitia was impeded not only by tough conditions but also by a generally accepted belief that the rain forest soils of Central and South America were too poor to support more than scattered hunter-gatherers, certainly too poor to maintain the intensive agriculture necessary to develop complex hierarchical societies. This was true despite the fact that when archaeologists first began to explore Mosquitia in the 1930s, they uncovered some settlements, suggesting that the area was once occupied by a widespread, sophisticated culture—not surprising, considering that the region lay at the crossroads of trade and travel between the Maya and other Mesoamericans to the north and west, and the powerful Chibcha-speaking cultures to the south.

Explorers, prospectors, and aviators spoke of glimpsing the ramparts of a ruined city rising above the jungle.

The Mosquitia people took on aspects of Maya culture, laying out their cities in vaguely Maya fashion. They probably adopted the famous Mesoamerican ball game, a ritual contest sometimes involving human sacrifice. But their exact relationship to their imposing neighbors remains unknown. Some archaeologists have proposed that a group of Maya warriors from

Lidar helped researchers uncover ancient settlements in three valleys in Honduras inhabited by a little-known culture to the east of Mesoamerica. The region surrounding the valleys was later designated the Mosquitia Patrimonial Heritage Preserve.



Copán may have taken control of Mosquitia, ruling as an elite over the local population. Others think that the local culture simply embraced the characteristics of an adjacent, impressive civilization.

One important distinction between the two cultures was the Mosquitia people's choice of building materials. There is no evidence yet that they built with cut stone, constructing their public edifices instead out of river cobbles, earth, wood, and wattle and daub. When these buildings were decorated and painted, they may have been as remarkable as some of the great temples of the Maya. But once abandoned, they dissolved in the rain and rotted away, leaving unimpressive mounds of dirt and rubble that were quickly swallowed by vegetation. The disappearance of this splendid architecture could explain why this culture remains so "marginalized," according to Christopher Begley of Transylvania University in Lexington, Kentucky, who has carried out archaeological surveys in the Mosquitia region. The culture is still so under-studied that it has not been given a formal name.

"There is much we don't know about this great culture," Oscar Neil Cruz told me. Mexican by birth, Neil is chief of archaeology for the Honduran Institute of Anthropology and History (IHAH). "What we don't know, in fact, is almost everything."

WHEN SO LITTLE IS KNOWN, anything is possible. In the mid-1990s a documentary filmmaker named Steve Elkins became captivated by the legend of the White City, and embarked on an effort to find it. He spent years poring through reports from explorers, archaeologists, gold prospectors, drug smugglers, and geologists. He mapped out which areas of Mosquitia had been explored and which had not. He hired scientists at NASA's Jet Propulsion Laboratory (JPL) in Pasadena, California, to analyze reams of data from Landsat and radar images of Mosquitia, looking for signs of ancient settlements. The JPL report showed what might be "rectilinear and curvilinear" features in three valleys, which

Society Grant Your National Geographic Society membership is helping fund a Honduran-American expedition to excavate the artifacts in Mosquitia.

JEROME N. COOKSON, NGM STAFF; AMANDA HOBBS. SOURCES: CHRISTOPHER BEGLEY, TRANSYLVANIA UNIVERSITY; OSCAR NEIL CRUZ, HONDURAN INSTITUTE OF ANTHROPOLOGY AND HISTORY; JUAN CARLOS FERNÁNDEZ-DIAZ, NCALM/UNIVERSITY OF HOUSTON; CHRISTOPHER T. FISHER, COLORADO STATE UNIVERSITY; UTL PRODUCTIONS



Among the artifacts found is a carved face—part jaguar, part human—about the size of a fist. Excavation of the site could provide clues to an ancient culture so little known it has no name.



Elkins labeled T1, T2, and T3, the *T* standing for "target." The first was an unexplored river valley surrounded by ridges, forming a natural bowl. "I just thought," Elkins said, "that if I were a king, this would be the perfect place to hide my kingdom." But the images were inconclusive; he would need a better way to peer through the dense jungle canopy.

Then, in 2010, Elkins read an article in *Archaeology* magazine that described how a technique called lidar (short for light detection and ranging) had been used to map the Maya city of Caracol, in Belize. Lidar works by bouncing hundreds of thousands of pulses of infrared laser beams off the rain forest below, recording the point location of each reflection. The three-dimensional "point cloud" can be manipulated with software to remove the pulses that hit trees and undergrowth, leaving an image composed only of pulses reaching the underlying terrain—including the outlines of archaeological features. In just five days of scanning, lidar revealed that Caracol was seven times larger than had been thought from 25 years of on-the-ground surveying.

One downside of lidar is its expense. The Caracol survey had been carried out by the National Center for Airborne Laser Mapping (NCALM) at the University of Houston. For NCALM to scan just the 55 square miles of the three valleys would cost a quarter of a million dollars. Fortunately, by this time Elkins's unbounded eagerness to find the White City had infected Bill Benenson, another filmmaker, who was so taken with the project that he decided he would finance it himself.

The initial results were astonishing. There appeared to be ruins strung along several miles of the T1 valley. (I reported on this initial discovery in the *New Yorker* magazine in 2013.) A site twice the size was evident in T3. Although the larger structures were readily apparent, a finer analysis of the images would require the eye of an archaeologist skilled in the use of lidar. Elkins and Benenson turned to Chris Fisher, a specialist on Mesoamerica at Colorado State University.

Makings of a myth









PHOTOGRAPHED AT NATIONAL MUSEUM OF THE AMERICAN INDIAN, SMITHSONIAN INSTITUTION, BY (CLOCKWISE FROM RIGHT) ERNEST AMOROSO (7274); MARK THIESSEN, NGM STAFF (202824, 202823, 202825)

The stone armadillo below from Mosquitia helped inspire collector George Gustav Heye to dispatch Theodore Morde and others in the 1930s and '40s to search for a legendary White City hidden in the jungle. Morde returned with artifacts including the ceramic figurines seen here—and news, never confirmed, that the city had been found.



Which is how Fisher came to be standing on the bank of an unnamed river in T1 in February 2015, staring at the wall of jungle on the other side and eager to plunge in.

FROM THE MOMENT Fisher saw the lidar images, he was hooked. He had used the technology to map Angamuco, an ancient city of the fierce Purépecha (Tarascan) people, who rivaled the Aztec in central Mexico from around A.D. 1000 until the arrival of the Spanish in the early 1500s. While the communities of the Mexican highlands in pre-Columbian America were densely packed, those in the tropics tended to be spread out across the landscape—ancient Los Angeleses, as opposed to Manhattans. Nevertheless, the sites in T1 and T3 looked substantial—certainly the largest settlements mapped so far in Mosquitia. The core area in T3 was almost one and a half square miles—nearly the size of the central area of Copán, the Maya city to the west. T1's center was smaller but more concentrated, appearing to consist of ten large plazas, dozens of associated mounds, roads, farming terraces, irrigation canals, a reservoir, and a possible pyramid. Because of the evident ceremonial architecture, earthworks, and multiple plazas, Fisher had no doubt that both locations fit the archaeological definition of a city, a settlement showing complex social organization, with clear divisions of space, intimately connected to its hinterlands. "Cities have special ceremonial functions and are associated with intensive agriculture," he told me. "And they usually involved major, monumental reconstruction of the environment."

In their quixotic attempt to locate a (probably) mythical White City, Elkins and Benenson apparently had found two very real ancient cities. With the help of the Honduran government, they gathered a team capable of penetrating the jungle to "ground-truth" what the lidar images had identified. Besides Fisher, who had more experience than anyone else in using lidar imagery to know where to look and what to look for on the ground, the team had two other archaeologists, including the IHAH's Oscar Neil Cruz; an anthropologist; a lidar engineer; two ethnobotanists; a geochemist; and a geographer. Also along were Elkins's camera crew and a team from *National Geographic*.

The logistics were daunting—aside from having to contend with snakes, insects, mud, and incessant rain, we would risk contracting malaria, dengue fever, and a smorgasbord of other tropical diseases. (The Editor's Note in this issue recounts the impact on the expedition team of leishmaniasis, a potentially lethal parasitic disease transmitted by a tiny sand fly.)

To ease the way, Elkins and Benenson had hired three ex-British Special Air Service (SAS) officers who had formed a company specializing in shepherding film crews in dangerous areas. They were dropped first at the site to clear landing and camp areas with machetes and chain saws while the helicopter returned to Catacamas to shuttle in Fisher and the others. Andrew "Woody" Wood, leader of the support team, later told me that as they worked, animals—a tapir, jungle fowl, and spider monkeys—wandered about or gathered in the trees above, seemingly unafraid. "I've never seen anything like it," he said. "I don't think these animals have ever seen human beings."

Wood had chosen a raised terrace behind the landing zone as the site for the base camp, set up amid giant trees, accessible by crossing a bridge of logs laid over a mudhole, with a climb up an embankment. Because of the danger of snakes—the highly venomous fer-de-lance, often referred to as "the ultimate pit viper," are particularly worrisome; they sometimes flee when disturbed, but they can also turn around and chase down an intruder—he had forbidden anyone to leave the camp unescorted. But Fisher was impatient; accustomed to dangerous fieldwork at his Mexican site, he threatened to explore on his own. In late afternoon, Wood agreed to a quick reconnaissance of the ruins. The advance team assembled on the riverbank in full jungle kit, wearing snake gaiters and stinking of insect repellent. A Trimble GPS unit, in which Fisher had downloaded the lidar maps, showed his exact location in relation to the presumed ruins.





Archaeologist Oscar Neil Cruz (top) carefully brushes forest litter from a stone shortly after entering the ruins in Mosquitia. It proved to be one of some 50 flat stones (above) encircling a plaza—the first architectural elements discovered at the site. Their purpose is still unknown.



The unexcavated artifacts include carved stone seats called *metates.* Honduran President Juan Orlando Hernández has ordered a military presence at the site to protect it from looters.



Consulting the GPS, Fisher called directions to Wood, who whacked a trail through a thicket of false bird-of-paradise, showering the group with blossoms. The forest thrummed with the sounds of birds, frogs, toads, and insects. We forded two mudholes, one thigh-deep, climbed the bluffs above the floodplain, and arrived at the base of a steep, jungle-clad prominence—the edge of the presumed city. "Let's go to the top," Fisher said. The ground-truthing had begun.

Clinging to vines and roots, we ascended the slippery, leaf-strewn slope. At the summit, thick with vegetation, Fisher pointed out a subtle but unmistakable rectangular depression, which he believed to be the outline of a building. Kneeling down for a better look, Neil uncovered what appeared to be evidence of deliberate construction, supporting the interpretation of it as an earthen pyramid. Fisher was elated. "It's just as I thought," he said. "All this terrain has been modified by human hands."

Fisher and Wood led the team down from the pyramid into what Fisher hoped was one of the city's ten "plazas," or large public spaces. As we entered the area, we found a stretch of rain forest as artificially level as a soccer field. Linear mounds surrounded it on three sides, the remains of walls and buildings. A gully cut through the plaza, exposing a surface paved with stones. Crossing the plaza, we discovered on the far side a row of flat, altar-like stones perched on tripods of white boulders. The thick vegetation, however, continued to block any sense of the layout or scale of the ancient city. With the sun beginning to set, we returned to camp.

We awoke the next morning and set off to explore again, a thick fog reverberating with the calls of howler monkeys. Mats of vines and dripping flowers hung down in the green gloom. Surrounded by the immense trees and the silent mounds—remnants of another people, another time—I felt the connection to the present moment melt away. A clamor in the upper treetops announced the beginning of a downpour. Several minutes elapsed before the rain reached the ground. Soon we were soaked.

Fisher, wielding his machete, hiked north with Neil and Juan Carlos Fernández-Diaz, the team's lidar engineer, to map more plazas of the city. Anna Cohen, a doctoral candidate from the University of Washington, and Alicia González, the expedition's anthropologist, stayed behind to clear vegetation away from the row of stones. Toward afternoon Fisher and his group returned, having mapped three more plazas and many mounds. Everyone drank a round of hot, milky tea in the pouring rain. Wood ordered a return to camp, concerned that the river might be rising. The team departed in single file. Suddenly cameraman Lucian Read, near the end of the line, called out.

The finds were in perfect condition, likely untouched since they'd been left behind centuries before.

"Hey, there are some weird stones over here."

At the base of the pyramid, just poking out of the ground, were the tops of dozens of beautifully carved stone sculptures. The objects, glimpsed among leaves and vines, and covered with moss, took shape in the jungle twilight: the snarling head of a jaguar, a stone vessel decorated with a vulture's head, large jars carved with snakes, and a cluster of objects that looked like decorated thrones or tables, which archaeologists call *metates.* All the artifacts were in perfect condition, likely untouched since they'd been left behind centuries before.

There were shouts of astonishment. People crowded around, bumping into one another. Fisher quickly took charge, ordering everyone back and roping off the area with police tape.

But he was just as jazzed as the others, maybe more so. Although similar objects were well-known from other parts of Mosquitia, most were one-offs found long ago by Morde and others or dug up and carted off by local people or looters. Certainly no such cache had been recorded in the literature. There were 52 objects showing aboveground—and who knows how many more below the surface.

"This is a powerful ritual display," said Fisher, "taking wealth objects like this out of circulation and leaving them here, perhaps as an offering."

In the days that followed, the team of archaeologists recorded each object in situ. Using a tripod-mounted lidar device, Fernández scanned the artifacts as well, creating 3-D images of each. Nothing was touched, nothing removed: That would wait for another time, when the team could return with the proper equipment and time to do a careful excavation.

AT THE TIME OF THIS WRITING, another, more extensive expedition is indeed being planned, with the full support of the Honduran government. Plagued by narcotics trafficking and the accompanying violence, Honduras is a poor country in need of good news. Ciudad Blanca, the White City, may be a legend—but anything that brings that story closer to reality generates great excitement; it is a point of collective pride, an affirmation of the people's connection to their pre-Columbian past. Upon learning of the discovery of the cache, Juan Orlando Hernández, the president of Honduras, ordered a full-time military unit to the site to guard it against looters. Several weeks later he helicoptered in to see it firsthand, and pledged that his government would do "whatever it takes" to further not only the investigation and protection of the valley's cultural heritage but the ecological patrimony of the surrounding region as well.

The investigation has only begun. Most of the T1 valley remains to be surveyed, and the even more extensive ruins in T3 have not been approached. And who knows what lies beneath the jungle canopy veiling the rest of Mosquitia? In recent years there has been a fundamental change in the way archaeologists think pre-Columbian people inhabited tropical landscapes. In the old view, sparsely populated human settlements were dots on a mostly unoccupied terrain. In the new view, settlements were densely populated, with far less empty space between them.

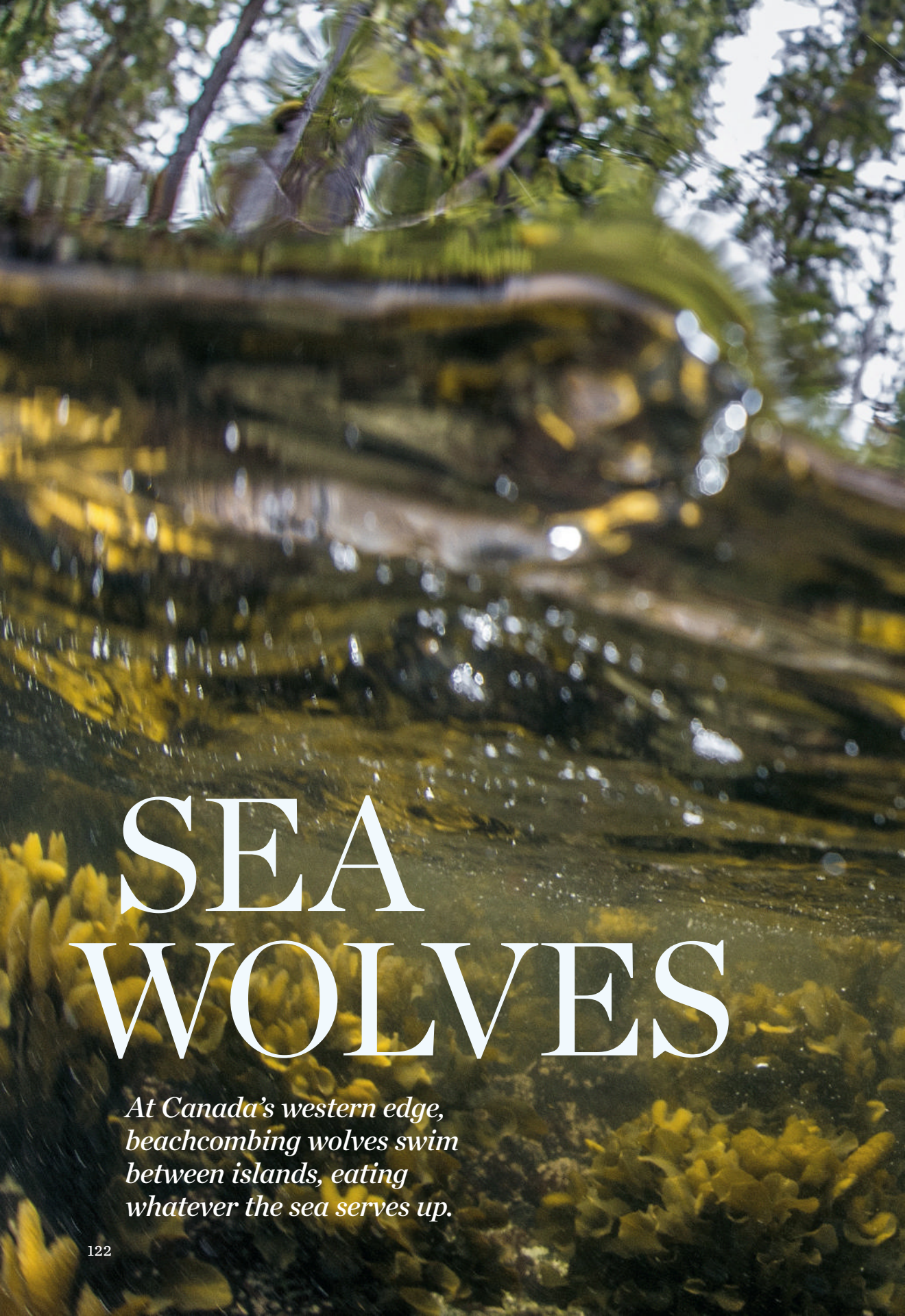
"Even in this remote jungle environment," said Fisher, "where people wouldn't expect it, there were dense populations living in cities—thousands of people. That is profound."

What we still have to learn about the former inhabitants of Mosquitia is practically unlimited. But the time to learn it may not be. In February, as we flew out of T1 back to Catacamas, within just a few miles the unbroken rain forest gave way to slopes scarred by clearings for cattle ranching—ugly, threadbare patches on an otherwise luxurious coat. Virgilio Paredes, the director of the Honduran Institute of Anthropology and History, under whose auspices the expedition operated, calculated that at the present rate, clear-cutting will reach the T1 valley in eight years or less, destroying possible cultural treasures and leaving others open to rampant looting. President Hernández has pledged to protect the region from deforestation as well as looting, in part by establishing the Mosquitia Patrimonial Heritage Preserve, an area of about 785 square miles surrounding the valleys surveyed by lidar. But the issue is delicate. Though the cutting is illegal—the area is supposedly protected within the Tawahka Asangni and Río Plátano Biosphere Reserves—cattle ranching is an economic boon and a cherished tradition in this part of Honduras.

If the discoveries in T1 tip the scale toward preservation, then it doesn't matter whether the White City is real or myth. The search for it has led to riches. □



Dave Yoder seems to have a thing for ancient cities—he also shot August's cover story on Pope Francis. "In many ways," he says, "the Vatican was more difficult to penetrate than the jungle."



SEA WOLVES

At Canada's western edge, beachcombing wolves swim between islands, eating whatever the sea serves up.



This wolf took a break from eating herring roe to investigate a half-submerged object: the photographer's camera.

IAN MCALLISTER, PACIFIC WILD



Tides dictate coastal wolves' foraging habits on British Columbia's ocean islands. What morsels will wash ashore? Tide pools offer crabs, clams, barnacles, and other tidbits. A whale carcass can feed a family of wolves for a week.



By Susan McGrath
Photographs by Paul Nicklen



Smaller than their inland kin, wolves like this once roamed much of the West Coast. Today they're found only in British Columbia and southeastern Alaska.

"You feeling lucky?" Ian McAllister calls.

We're standing on a speck of an island, eight miles west of the British Columbia mainland. Wooded, windswept, it's one of thousands of islands along this storm-scoured coast, naught but a series of seal-draped rocks between this one and Japan. The April wind whips away my bark of disbelief that luck would come my way, and besides, McAllister—environmental activist, photographer, wolf whisperer—has already made up his mind. He settles into the windrow of bleached driftwood at the high tide line, and so do I. Before us, a gravel tide bar some hundred yards long connects our little island to another. Ensconced in our bony nests, we scan the far island's twisty green-gold Sitka spruce and cedar, the bladder wrack and eelgrass. And just like that, luck strikes.

A pale stick figure of a wolf steps out of the salals and picks its way down the bank to the beach opposite us. With its muzzle, it pokes at the eelgrass. It plants a paw on something, tears at it with its teeth—a dead salmon maybe. Then another wolf materializes alongside the first. The two touch muzzles, turn to the gravel bar, and begin to plod across its tide pools in our direction.

In our collective imaginations, wolves lope across the tundra after caribou or weave through timber in Big Sky country or stalk stray sheep. They're carnivores, hunting deer, moose, mountain goats, caribou, and anything else running about on hooves. Indeed, wolves barely more than howling distance inland make their living that way. But not out here. On the outer coast of British Columbia, whole generations of wolves have never seen a mountain goat or a moose. Some may have never seen a deer.

For decades headlines across the West have howled about wolves—their comebacks, their



setbacks, the debate about whether and how to manage them. They've been studied, profiled, vilified, and glorified. You'd think by this time we'd know all there is to know about them. But aside from *Homo sapiens,* there are few mammals more adaptable or more diverse in their habitats than *Canis lupus.* And these wolves of the British Columbia coast appear to be unique.

Chris Darimont, from the Raincoast Conservation Foundation, has spent over ten years developing a fine-grain picture of coastal wolves, which he lightheartedly calls "Canada's newest marine mammal." New to science, he means.

Halfway across the land bridge now, the pair of unlikely marine mammals paces into focus. The wolf on the right is nearly white with age. "Alpha female," McAllister calls out. The fur on her face is worn to fuzz, like a child's old stuffed toy. Her eyes are bald, round buttons. The other wolf, an alpha male, is an Adonis—tawny, with a loose mantle of black-tipped fur. The wolves reach our beach. Closer. Bigger. At last the matriarch stops, looks up. She coughs a growly, hostile chuff and disappears up the beach.

Adonis raises his head, loses his slump, pins me with his amber eyes—and keeps coming. Slow, deliberate, bold—ignoring McAllister and coming straight at me.



An island pack devours a dead sea lion. Wolves can't catch sea lions and seals in the water; instead they swim out and snag them as they're hauled out on rocks. These wolves, unlike inland ones, don't need to rely on deer for food but will hunt them where they're plentiful.

IAN McALLISTER, PACIFIC WILD



EVEN IF YOU OFFERED the prize of a pound of smoked salmon, most Canadians couldn't tell you much about British Columbia's remote coast. Vancouver Island bookends it to the south, the big Haida Gwaii Islands and southeast Alaska to the west and north, respectively. In between, open to the full fury of the Pacific, lies this coast. It stretches 250 miles as the raven flies. But glaciers raked deep fjords here during the last ice age, gouging a steep-sided labyrinthine and fingerlike tidal coastline. Icy, plankton-rich ocean currents bathe it, sustaining an extraordinary abundance of life in the sea—whales, seabirds, salmon, sea lions, seals—and on land, grizzly and black bears, including the fantastic white variant, the Kermode, or spirit bear. A misty temperate rain forest of conifers shrouds it all, from waterline to Coast Mountains crest. It's roughly 25,000 square miles in area—a Switzerland-and-a-half of forest—one of the biggest swaths of its kind left in the world. It's called the Great Bear Rainforest.

These wolves are beachcombers. They chew barnacles, scarf up the roe that herring lay on kelp, and feast on dead whales.

In the early 2000s Ian McAllister and Canadian wolf biologist Paul Paquet became intrigued when they saw coastal mainland wolves eating salmon. With local First Nations' support, they recruited graduate student Chris Darimont to investigate. Darimont narrowed his study area to Heiltsuk First Nations territory on the central coast—one-third of it water, the rest largely roadless, dense with towering Sitka spruce and cedar, and often extremely steep. Darimont and Paquet ditched the traditional approach of collecting blood and hair directly from the animal.

Society Grant This project was funded in part by your National Geographic Society membership.

"We collected poop," Darimont tells me. Wolf scat, he means, and also wolf hair, veritable libraries of data about home range, sex, diet, genetics, and other variables. "Wolves are deliberate poopers, not random like deer," Darimont says, "and they use travel corridors very reliably." Wolves' anal glands add oily deposits to scat, appending messages intended for other wolves. They favor posting their messages conspicuously, especially at trail intersections, where one missive gets twice the readership.

"I'd throw a mountain bike out of the boat onto a logging road or game trail and spend ten sweaty hours scat hunting," Darimont says.

Ten years, innumerable poop jokes, more than 3,000 miles, and 7,000 samples later—autoclaved, washed, bagged, labeled, and eventually stored in Darimont's mother's basement—the feces began to deliver the facts.

The data from coastal wolves along the mainland quantified what many locals already knew: Wolves eat salmon. In spawning season the fish make up 25 percent of these wolves' diet.

The shocker came from the rest of the data. Going in, Darimont and Paquet had assumed that the coastal wolves on the islands were simply normal wolves that moved between islands and the mainland, pushing on whenever they'd polished off the deer. Instead the data showed that wolves can spend their whole lives on outer islands that have no salmon runs and few or even no deer. These wolves are more likely to mate with other islanders, not with salmon-eaters. And they're beachcombers. They chew barnacles. Scarf up the gluey roe that herring lay on kelp. Feast on whales that wash up dead. Swim out into the ocean and clamber nimbly up onto rocks to pounce on basking seals. "As much as 90 percent of these wolves' diet can come directly from the sea," Darimont says.

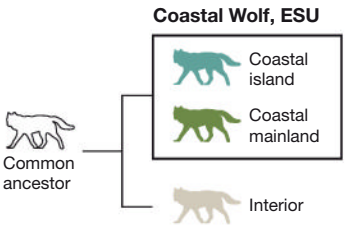
Most extraordinary is the wolves' swimming prowess. They often swim across miles of ocean between islands. In 1996 wolves showed up on Dundas Islands for the first time in the Tsimshian people's long collective memory—eight miles from the nearest land.

Paquet says these types of coastal wolves



COASTAL CANINES

Gray wolves have adapted to the diverse ecosystem of British Columbia's Coast Mountains since the end of the last ice age. In the temperate rain forests' outer shores live two types of coastal wolves that researchers suggest diverged from a common gray wolf ancestor into what's called an evolutionarily significant unit, or ESU, worthy of conservation.



Genetic differences and factors like diet and habitat are weighed when defining ecological types. Coastal wolves, with small genetic differences but strong environmental adaptations, likely constitute a separate group from interior wolves.

MATTHEW TWOMBLY, NGM STAFF; EVAN APPLEGATE

SOURCES: CHRIS DARIMONT, RAINCOAST CONSERVATION FOUNDATION; VIOLETA MUÑOZ-FUENTES AND JENNIFER A. LEONARD, DOÑANA BIOLOGICAL STATION; ALASKA GAP ANALYSIS PROJECT; BRITISH COLUMBIA MINISTRY OF FORESTS, LANDS, AND NATURAL RESOURCE OPERATIONS; NATURAL RESOURCES CANADA; U.S. FOREST SERVICE







Relatives babysit youngsters at rendezvous sites, and their parents bring them food until they're old enough to hunt—and beachcomb—with the pack. Coastal wolves can get as much as 90 percent of their food from the sea.

aren't an anomaly, they're a remnant. "There's little doubt these wolves once lived along Washington State's coast too. Humans wiped them out. They still live on islands in southeast Alaska, but they're heavily persecuted there." British Columbia permits almost unfettered hunting of wolves, but the vast, nearly roadless forest, low human population, and First Nations' tenure along this coast have made the Great Bear wolves' chances for survival look halcyon compared with the outlook for southeast Alaska's wolves.

Despite these advantages, and despite the wolves' impressive adaptability, their prospects are changing.

An energy project aims to run pipelines from Alberta's tar sands. The specter of the Exxon Valdez *disaster haunts many on this coast.*

A controversial energy project called the Northern Gateway Pipelines aims to bring twin pipelines from Alberta's tar sands across the Coast Mountains and down to a new terminal on a fjord far up into the province's northern coast. With the pipelines working at capacity, nearly every day a tanker could be making the perilous inland passage. At the same time multiple shipping terminals for liquefied natural gas from Canada's fracking fields are on the drawing board, promising even more tankers in these waters. The oily specter of the 1989 *Exxon Valdez* disaster in Prince William Sound haunts many on this coast. In a rare display of accord, dozens of First Nations bands officially opposed the Northern Gateway project last year. Will they have the clout to stop it? "Our Nations have been stewards of our homelands since time before memory," says Jessie Housty, a young Heiltsuk Tribal Council member who's actively opposing the project. "Northern Gateway can't break 10,000 years and more of guardianship."



The wolves will scarf down whole salmon but often eat just the nutritious brains. Biologist Chris Darimont says salmon offer more protein and fat than deer—and they don't kick.



CRISTINA MITTERMEIER

The photography of **Paul Nicklen,** a frequent *National Geographic* contributor, focuses on the delicate relationship between healthy ecosystems and marine wildlife—particularly in polar environments.

Were the wolves difficult to photograph? Contrary to our perceptions, the wolves were incredibly shy. I would sleep by the river, after seeing nothing all day, and often hear the wolves chasing salmon at night. I had only three days of productive shooting over three months of trying.



Nevertheless, at such times, an ancient, rugged coast can suddenly appear fragile.

THE MALE WOLF STALKS nearer, closer. Bigger. My eyes flicker over to McAllister. His expression: impassive. Has he brought pepper spray? I don't think so. I review in my mind what I know about wolves. Does one look a wolf in the eye? The wolf is close now, 20 feet from me and still coming. Staring. Staring.

Then, as if breaching from the waves, a third wolf porpoises up from below the driftwood directly in front of me—a younger, redder replica of Adonis. It slams an adoring cheek against the male's, whimpering ecstatically, nuzzling his face from below in an exuberant display of affection. For a moment longer Adonis's gaze stays locked on mine. Then he turns to greet the joyful youngster. The younger wolf ambles toward the water and lies down on the sand. As my eye follows the youngster, the alpha male vanishes. And just as suddenly reappears at my left, downwind of me, on my drift log. My breath catches. He sniffs the air. Drills me with his eyes. Then he abruptly loses interest in our conversation. He steps down to the beach, lies down near his offspring, and gazes out across the wild gray Pacific Ocean, where food comes from. □



Coastal wolves live mostly unmolested in a wild landscape—for now. Sixty percent of Great Bear Rainforest's old growth is open to logging, and energy giants want to send huge oil and gas tankers through the coast's winding channels.



Abstraction Finds Beauty in Beasts

Story and Photo Illustrations by
MICHAEL D. KERN

People have an almost primeval fear of reptiles, amphibians, and arachnids. As humans have evolved, we've learned to avoid these animals—for good reason, in many cases. That means most of us never get to experience and appreciate their beauty. And some of these species need our help. By using abstraction to remove fear and prejudice, I'm trying to help people see the beauty in the beast.

I start by shooting a portrait of an animal, then I deconstruct it into its most basic elements: color, line, pattern, texture. Those isolated features are the building blocks of a new image, which I alter in Photoshop—making a mirror image of a cropped portion, cropping a portion of the mirrored image, and so on. The result is a pair of portraits: one abstract, one of reality.

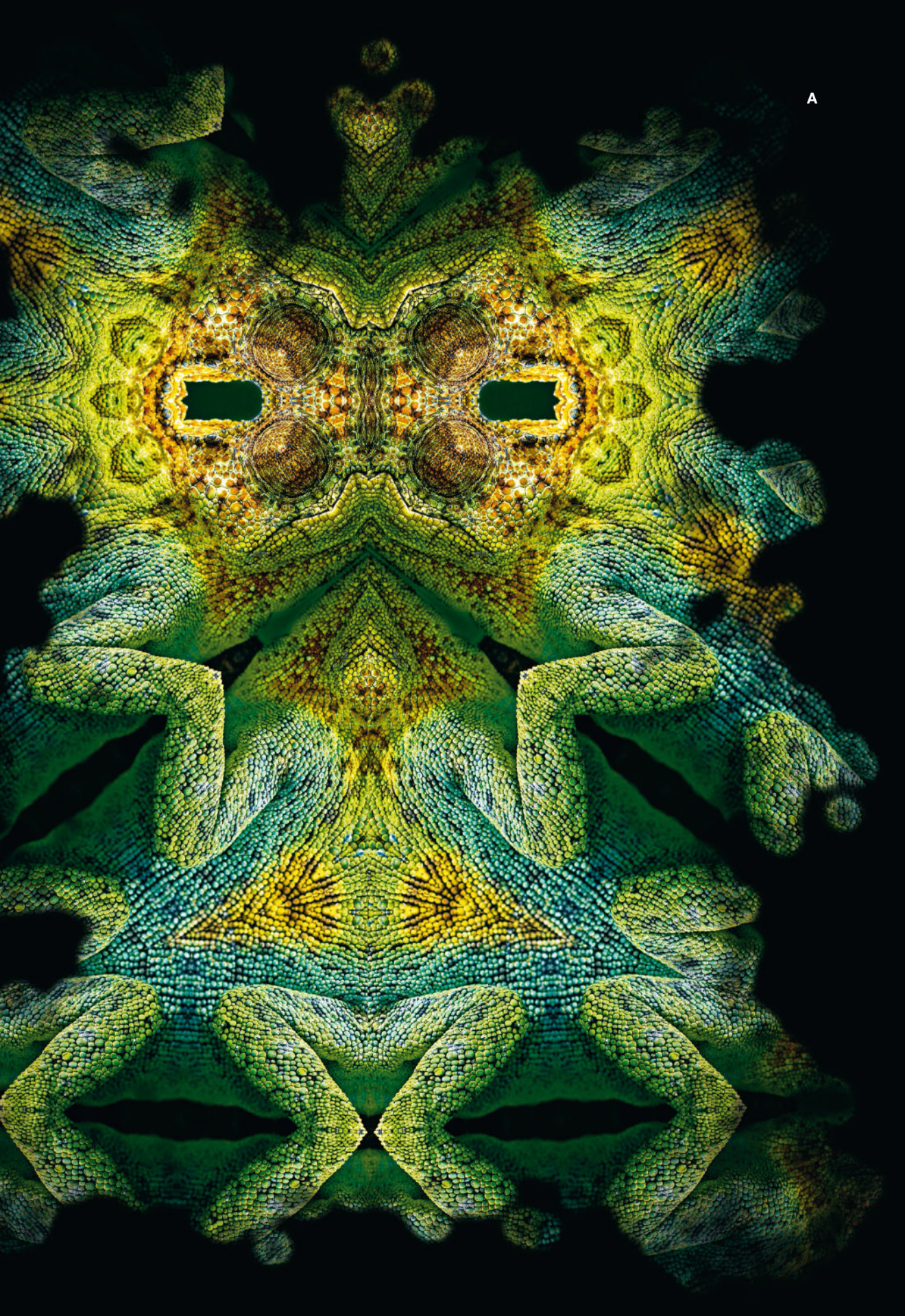
I began this series almost by accident. I wanted to create a letterhead logo for my photography business, and since I'd always loved reptiles, I photographed an iguana. I thought one of its eyes was striking as a stand-alone picture, but it wasn't the right size for the letterhead. So I tried mirroring the image on top of itself. What emerged was both beautiful and surreal—unlike anything in nature, even though it was wholly based in nature.

Each abstraction I make is different; there's no formula. Sometimes it takes just one crop and mirroring, and the image is complete; other times it takes much more. And some don't work at all. But for me the journey is as interesting as the destination. Watching the image evolve with each iteration is gratifying; I get to be both creator and observer of the process and its results.

At my shows I like to present the abstract images first. Initially when people look at them, I think they sense a tension between the prettiness of a picture and their fear of the subject it's made from. But as they realize it's just a picture, they creep closer, studying the details. When I'm successful, their fear changes to fascination. At this point I hope they can enjoy equally the beauty of both the abstract and realistic images. I think that's the value of what I'm creating: getting people to open up and appreciate these animals, which I hope might be a first step toward protecting them.

A century ago the cubists reduced natural forms to their geometric equivalents and changed perceptions in the process. I hope that my work, like theirs, can be understood on multiple levels: as a pretty picture, as a puzzle to piece together, and as a means of empathizing with species that need saving. ▯



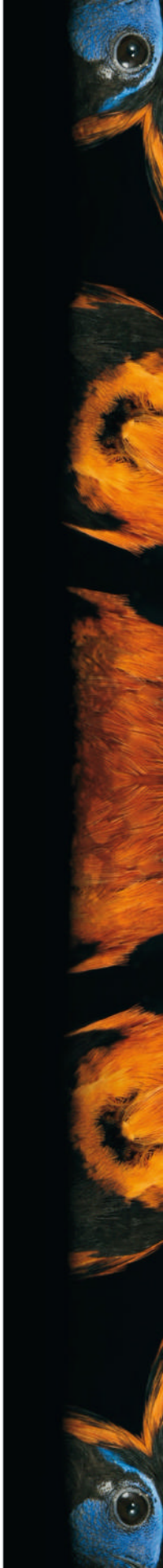

A

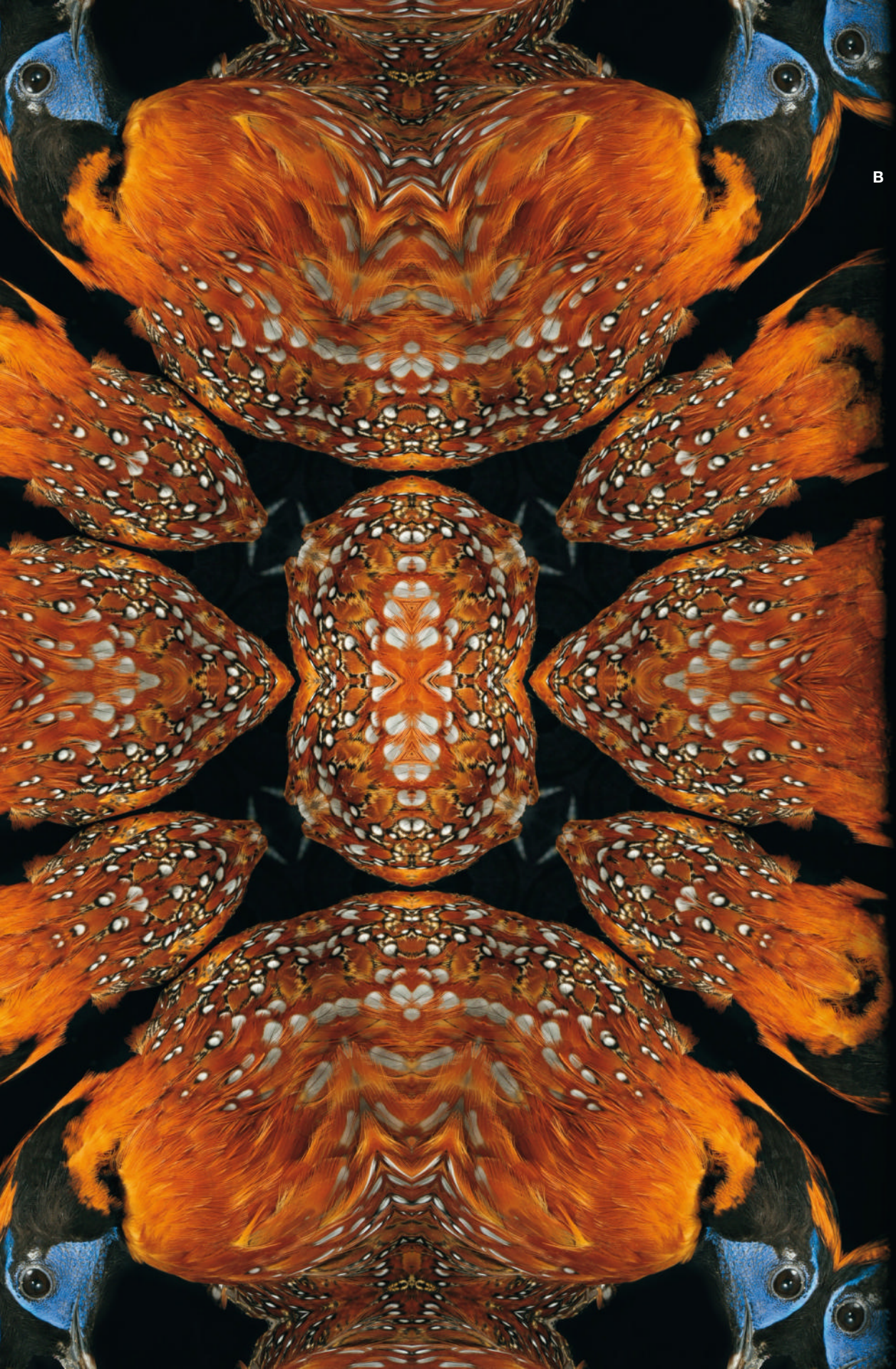




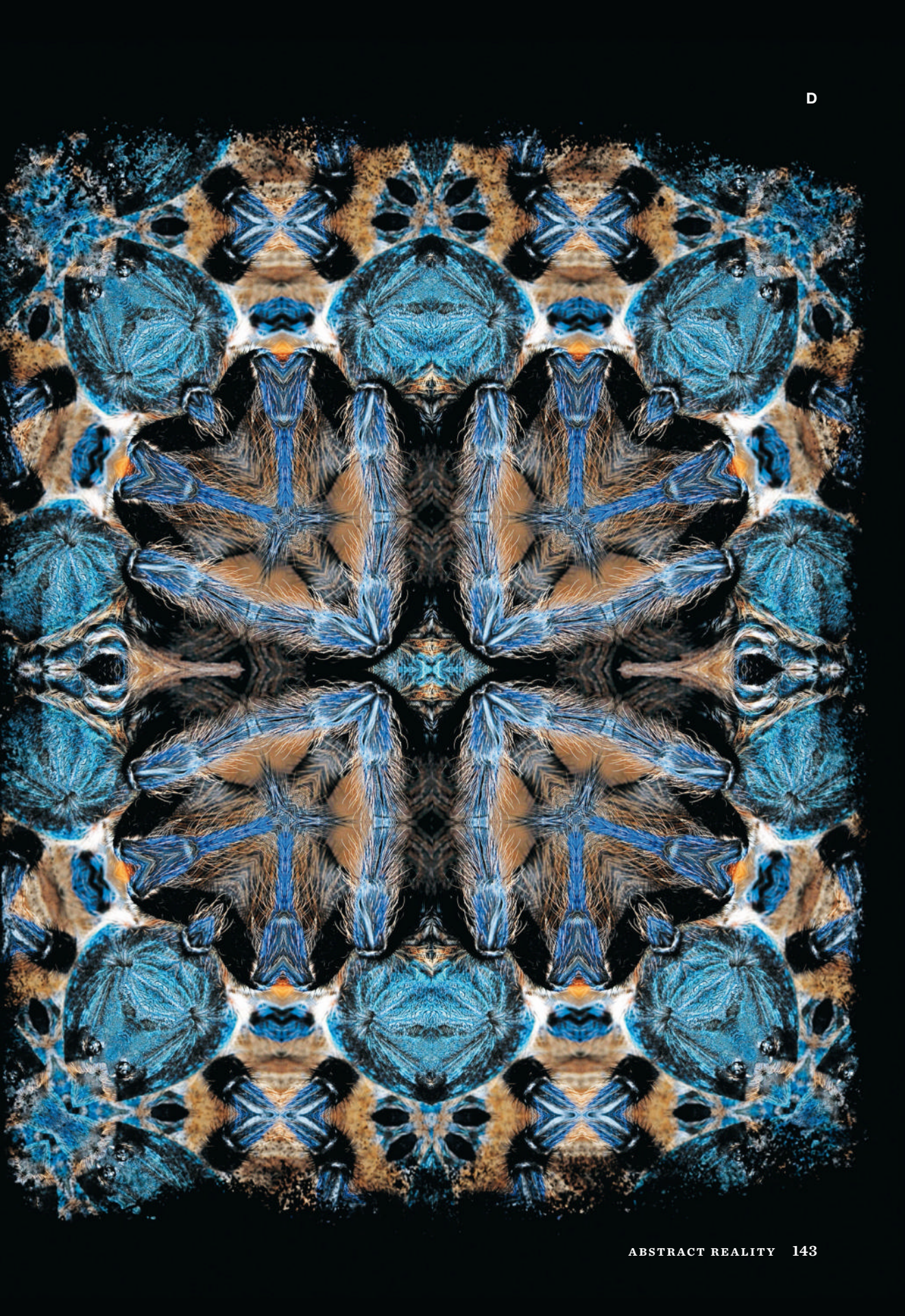
I consider myself an imagemaker first and foremost; my job is to make images that are both beautiful and impactful. To me the Abstract Reality series is the best of both worlds. I get to photograph these animals in their purest form and then improvise to create an alternative reality through cropping and mirroring features, such as the face and legs of a Johnston's three-horned chameleon (A) and the head and plumage of a Temminck's tragopan (B).

BOTTOM LEFT: PHOTOGRAPHED AT PANDEMONIUM AVIARIES, LOS ALTOS, CALIFORNIA

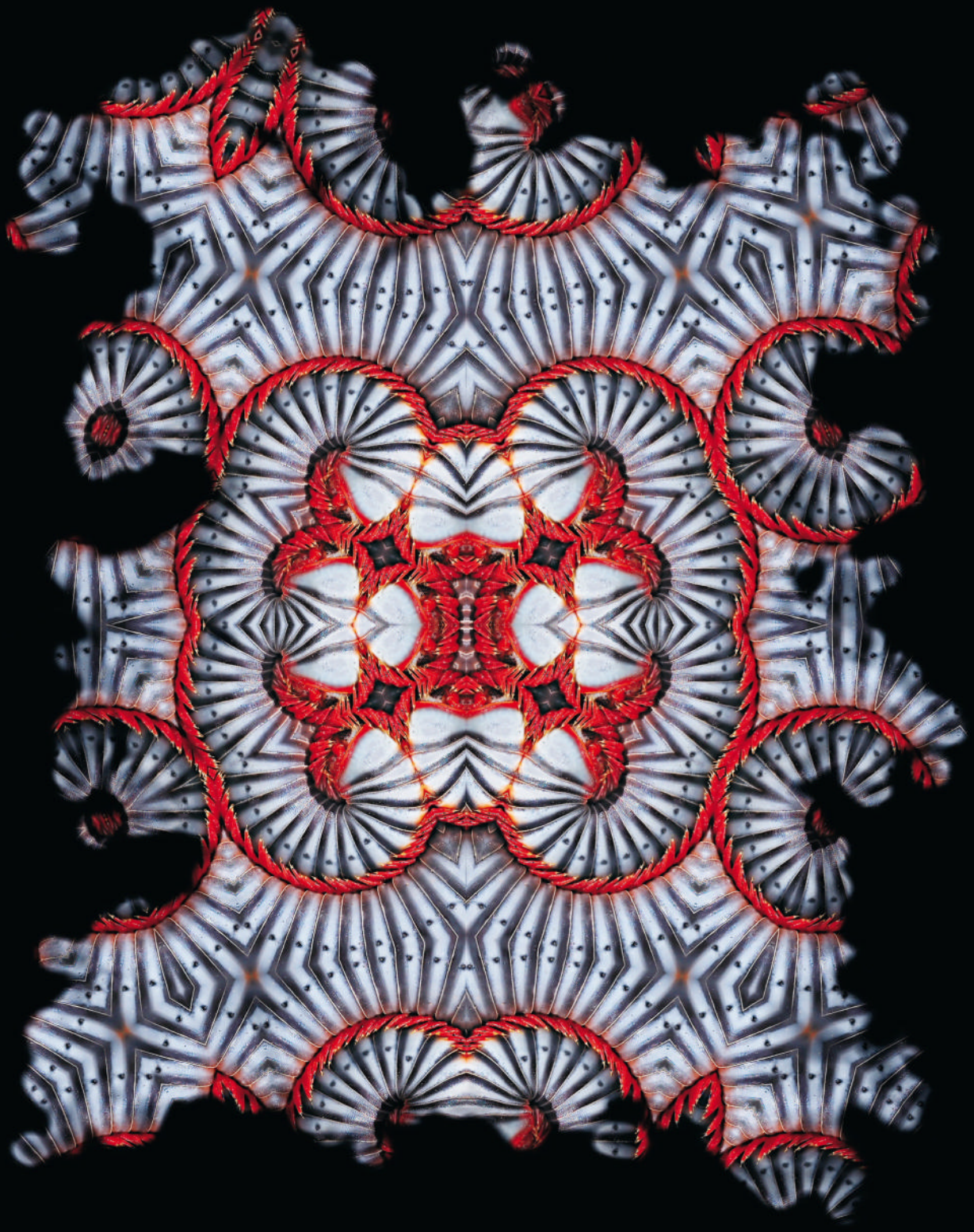



B


c




E



G













I've been drawn to reptiles and amphibians since I was a kid; in fact, they're what initially sparked my passion for photography. In making this series, I've found that other uncommon or overlooked species—especially in the arachnid and invertebrate families—make great subjects as well. These include the variable bush viper (C), the greenbottle blue tarantula (D), the panther chameleon (E), the rainbow millipede (F), and the African flower mantis (G).



The Cave Man



"This decorated nook…gives some suggestion of the reckless abandon with which the Cavern is supplied with ornamental furnishings," say notes accompanying this photo by Willis T. Lee, leader of a six-month-long National Geographic expedition to New Mexico's Carlsbad Caverns. The woman seen in the loupe appears in several of Lee's images; she may be his daughter.

Lee's article on this trip ran in our September 1925 issue. All did not go well. Describing how he carried a leaky can of gas on his shoulder (and writing in the third person), he reports that he "noticed a slight dampness in the clothing on his back, but gave it little attention until his flesh began to smart… Not realizing that a gasoline blister may be serious, he continued to work for several hours. With the help of a doctor, he spent the next ten days in growing new skin." *—Margaret G. Zackowitz*

PHOTO: WILLIS T. LEE, NATIONAL GEOGRAPHIC CREATIVE

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